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RPI TECHNICAL REPORT MP-82

A DETAILED EVALUATION OF A LASER TRIANGULATION RANGING SYSTEM FOR MOBILE ROBOTS

by

Thomas J. Clement
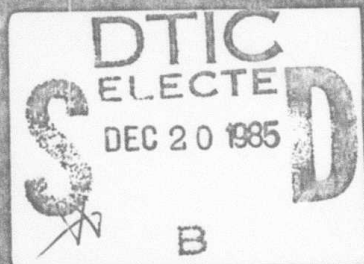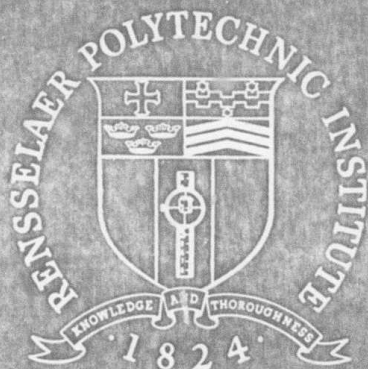
Rensselaer Polytechnic Institute

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ABSTRACT

This report is the culmination of several theoretical and design papers on a low resolution, short range vision system to be used for planetary exploration. Included is a theoretical discussion of the Scanning Laser / Multi-Detector laser triangulation system, designed and built in the Rensselaer Polytechnic Institute Mars Rover Laboratory. Discussed in depth is the actual test performance of the Scanning Laser / Multi-Detector System.

All tests presented were performed in controlled, static, laboratory conditions. To add to the credibility of the tests, the materials used were of the same reflective properties as dirt. The actual tests performed included: single step tests, single slope tests, multiple step tests, and range tests. All of these tests were performed to show the capabilities of the vision system and its ability to detect the presence of terrains hazardous to the safety of the vehicle.

The results showed both the vision system's strengths and weaknesses. Of special interest was that many of the limitations uncovered were software based. The test results are included in the Appendix.

PART 1

INTRODUCTION AND HISTORICAL REVIEW

In the last several years, tremendous advances have been brought about in the field of robotics. This has been due, in part, to advances in vision systems technology and in the development of artificial intelligence for interpreting the data obtained. The Mars Rover Project at Rensselaer Polytechnic Institute has been a product of these advances.

Since 1968, when the effort began under a NASA grant, the project has undergone many changes both in the design goals and in the physical vehicle. In the beginning, the goal was to create a vehicle which could negotiate rocky terrain with little difficulty. Mathematical models were created to determine various stresses and strains due to inertial forces as well as external forces which may be present (see Reference 14). Particular attention was paid to the design of the wheels. The vehicle at one time, was a two wheel drive device which could fold itself into a small package, facilitating transportation to Mars. Because of difficulties the vehicle encountered negotiating certain obstacles, it was later decided to give it four wheel drive.

Once most of the design and construction of the vehicle itself was completed, attention was placed on the design of an onboard vision system. The need for a vision system was prompted by the desire to include a shortrange terrain navigation system on the vehicle. A local navigation system was wanted because the communications time between Earth and Mars varies from 9 to 40 minutes, depending on the distance between them. Obviously, having to transmit a view of the terrain to Earth, process the information, and send a command back would take an exorbitant amount of time and the vehicle wouldn't get very far very fast. The need for a vision system was first filled by a Single-Laser/Single-Detector (SL/SD) mast, Figure 1. The laser fired 15 azimuth pulses per scan and the detector could detect relatively gross hazards at distances of 1.5 meters and heights of 0.25 meters, Figure 2. The addition of the vision system's mast precluded the vehicle's folding ability. Since the vision system was determined to be of greater importance than the ability of the vehicle to fold, this was a more than equitable loss. The testing done was with the vehicle outdoors on terrain very similar to what would have been expected to be encountered on Mars. Extensive testing proved that the system worked as designed (Reference 6).

The simple "hazardous/not hazardous" resolution of the system was determined to be overly conservative and so a new system design was sought. Using what had been learned from the design of the
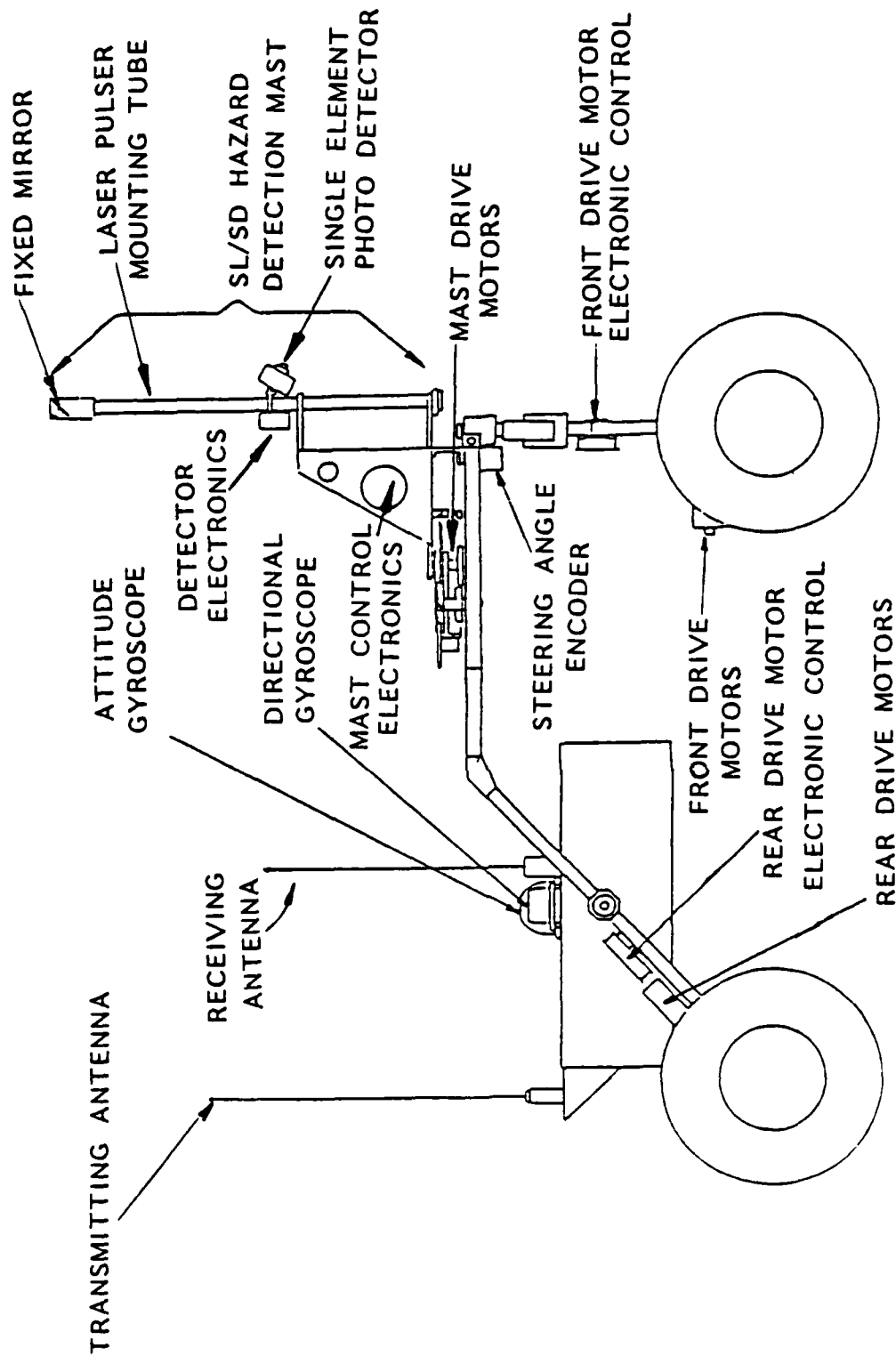
FIGURE 1. MARS ROVER WITH SL/SD SYSTEM

Labels:
- FIXED MIRROR
- LASER PULSER MOUNTING TUBE
- SL/SD HAZARD DETECTION MAST
- SINGLE ELEMENT PHOTO DETECTOR
- MAST DRIVE MOTORS
- FRONT DRIVE MOTOR ELECTRONIC CONTROL
- ATTITUDE GYROSCOPE
- DETECTOR ELECTRONICS
- DIRECTIONAL GYROSCOPE
- MAST CONTROL ELECTRONICS
- STEERING ANGLE ENCODER
- FRONT DRIVE MOTORS
- REAR DRIVE MOTOR ELECTRONIC CONTROL
- REAR DRIVE MOTORS
- TRANSMITTING ANTENNA
- RECEIVING ANTENNA

SCAN OF LASER

LASER PULSE

DETECTOR
CONE OF VISION

FIGURE 2. LASER SCAN PATTERN OF SL/SD SYSTEM

SL/SD system, a Multi-Laser/Multi-Detector (ML/MD) system was designed and built (see References 1, 3, 5, 7, 11). In addition to the actual hardware that made up the new vision system, there was also simulation as well as realtime software written to interpret the data which the new mast provided (see References 4, 10).

The Mars Rover Vehicle has thus evolved into a dual-microprocessor controlled vehicle able to negotiate rough terrain with a Multi-Laser/Multi-Detector vision system. The development of the new vision system mentioned above included: the design of a new mast with the associated drive electronics and mechanics, the design of a new microprocessor board to control the flow of data to a mainframe computer, and the development of new software to interpret the information obtained by the mast.

Throughout these recent developments, there has been relatively little done to determine whether the modifications were improving the system or making it unnecessarily complicated. For instance, up until very recently there had been very little testing (Reference 9) done to determine how well the new detection hardware works. Some questions that need to be answered include: is this vision system reliable, does it do the assigned task of obtaining reasonably accurate data, do the benefits outweigh the possible problems of the added complexity of the system, and how accurate is the data obtained by the system?

This report will attempt to show some of the strengths and weaknesses of the vision system and should answer the questions raised concerning the accuracy of the obtained data. Since all tests will be performed in the relatively controlled environment of a laboratory, the question of reliability under adverse conditions can not be completely resolved; only obvious reliability problems will be pointed out. Inherent limitations of the system due to the system configuration will be discussed. Finally, suggestions for future modifications to improve upon the system are presented throughout.

PART 2

ML/MD VISION SYSTEM THEORY

In order for the test results to be understood, it must first be understood how the Multi-Laser/Multi-Detector Vision scanning system works. Therefore, the concepts of Laser Triangluation and of the scanning laser are presented first.

2.1 Laser Triangulation

The idea of laser triangulation is that, given a known angle of a laser being fired and a known angle of a detector receiving the returning light rays, the height and range of the terrain can be determined through applied geometry. This concept and associated equations are shown in Figure 3. By firing the laser at a series of elevation angles at a constant azimuth it is possible to obtain height and range data of the terrian for any particular azimuth (see Reference 15). The heights and ranges are determined from the intersection points of the laser and detector angles. A system with 18 laser elevations and 19 detector angles is shown in Figure 4.

LASER RAY ORIGIN

LASER RAY

β_i

α_j

H_β $H_{\alpha j}$

REFLECTED
RETURN

R_β

R_t

Z_t

SYSTEM ORIGIN

X
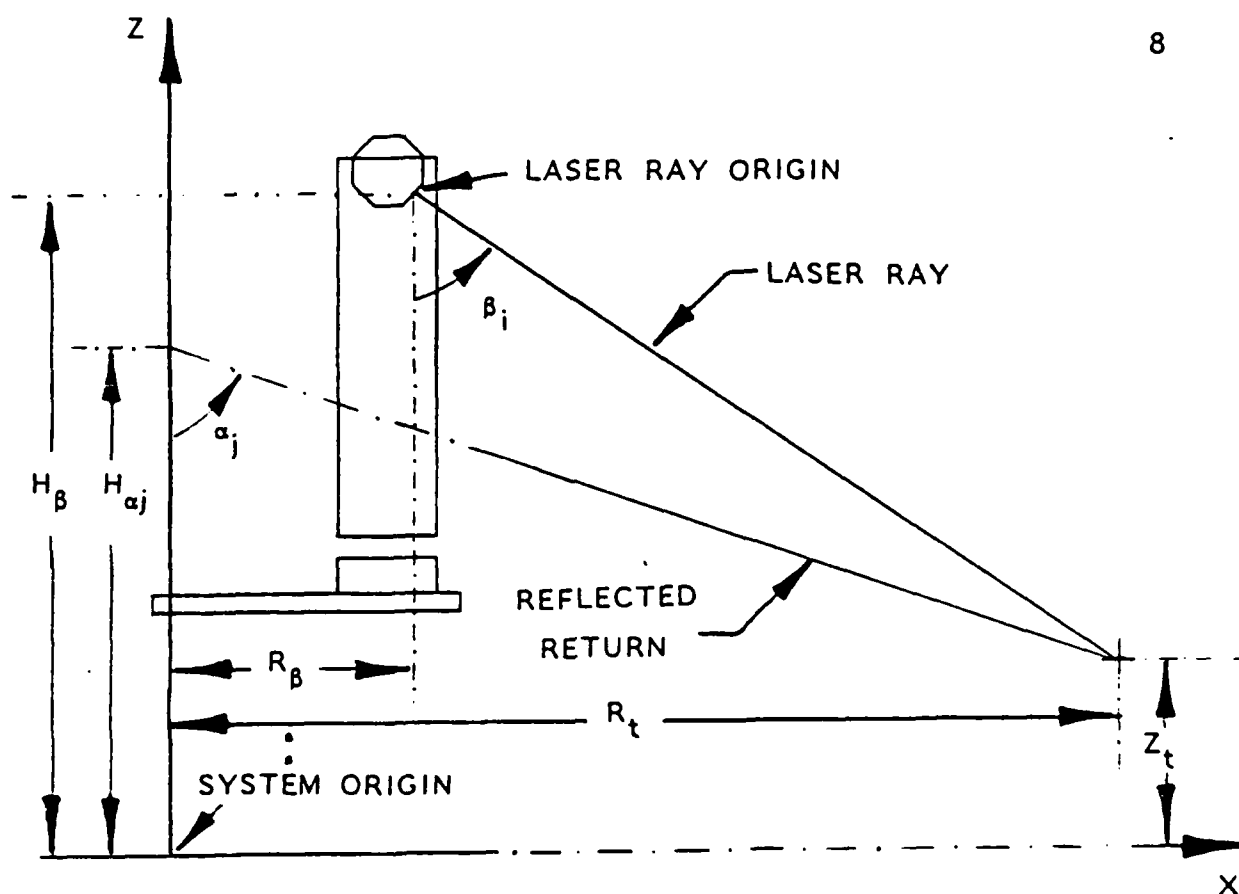
R_β = FORWARD DISPLACEMENT OF LASER RAY ORIGIN

H_β = HEIGHT OF LASER RAY ORIGIN

β_i = ELEVATION ANGLE OF LASER RAY

α_j = ANGLE OF LASER RETURN "SEEN" BY DETECTOR

$H_{\alpha j}$ = EFFECTIVE Z-AXIS INTERCEPT HEIGHT OF REFLECTED RETURN

Z_t = TERRAIN HEIGHT AT OBSERVED TERRAIN POINT

R_t = TERRAIN RANGE AT OBSERVED TERRAIN POINT

$$Z_t = \frac{H_\beta \, \text{TAN}_{\beta i} - H_{\alpha j} \, \text{TAN}_{\alpha j} \cdot R_\beta}{\text{TAN}_{\beta i} - \text{TAN}_{\alpha j}}$$

$$R_t = \frac{\text{TAN}_{\alpha j} \, (\, (H_{\alpha j} - H_\beta) \, \text{TAN}_{\beta i} - R_\beta)}{\text{TAN}_{\beta i} - \text{TAN}_{\alpha j}}$$

FIGURE 3. TRIANGULATION EQUATIONS
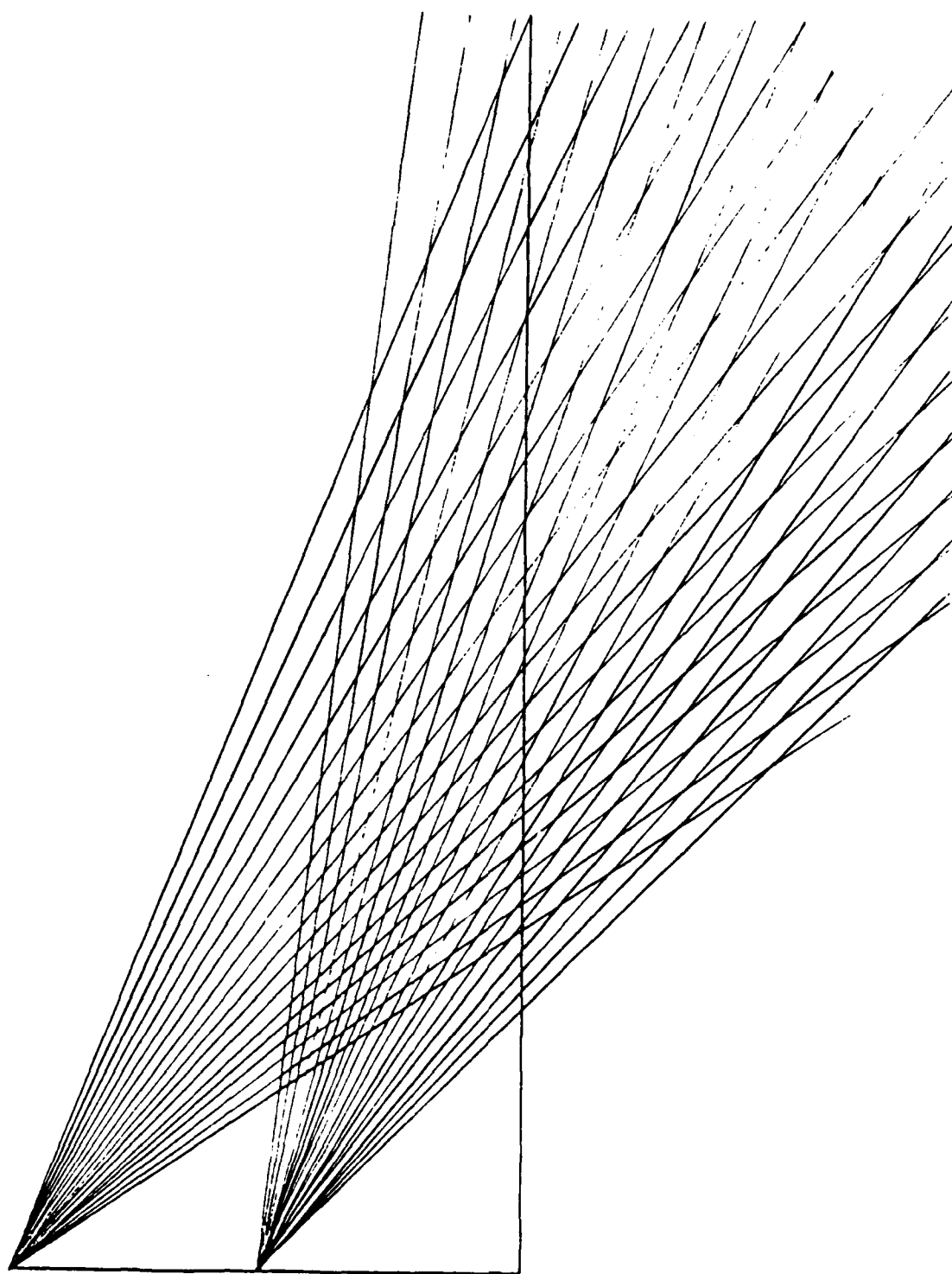
FIGURE 4. LASER/DETECTOR INTERSECTIONS

Assuming the use of a rotating or oscillating mast, which allows for several azimuths, there are at least two ways to produce several laser elevation shots per azimuth. One of these is to use several lasers, each firing at a slightly different elevation. Another method, the one used for the ML/MD system, is to use a single laser firing at multiple elevations to produce the effect of multiple lasers.

2.1.1 ML/MD Vision System Accuracy Factors

The accuracy of the data obtained by triangulation system depends on essentially three independent factors. They are: the laser characteristics, the detector characteristics, and the distance between the lasers and the detectors. The density of laser shots will affect resolution as depicted in Figure 5. The higher density of laser shots produces a more well defined envelope of the terrain. The angular resolution of the detectors is also a factor and is a function of the number of detectors and the desired total angular coverage. Finally, the accuracy is also affected by the distance between the lasers and the detectors as shown in Figure 6. Of these three factors, this one can provide the greatest improvement in accuracy in the easiest possible way, i.e. with just a simple change in component locations.

HIGHER DENSITY OF LASER SHOTS
ALLOWS FOR GREATER RESOLUTION
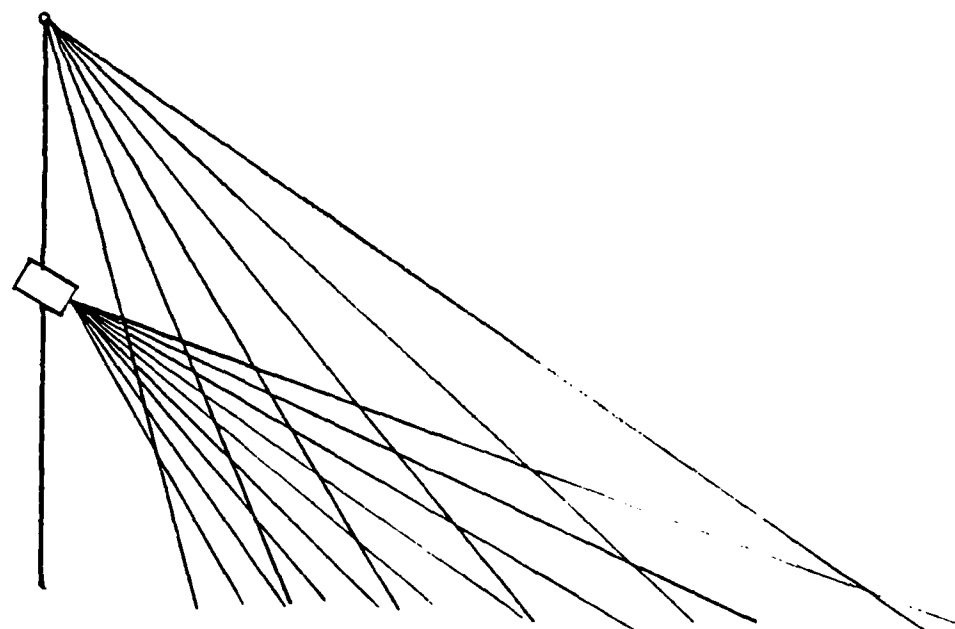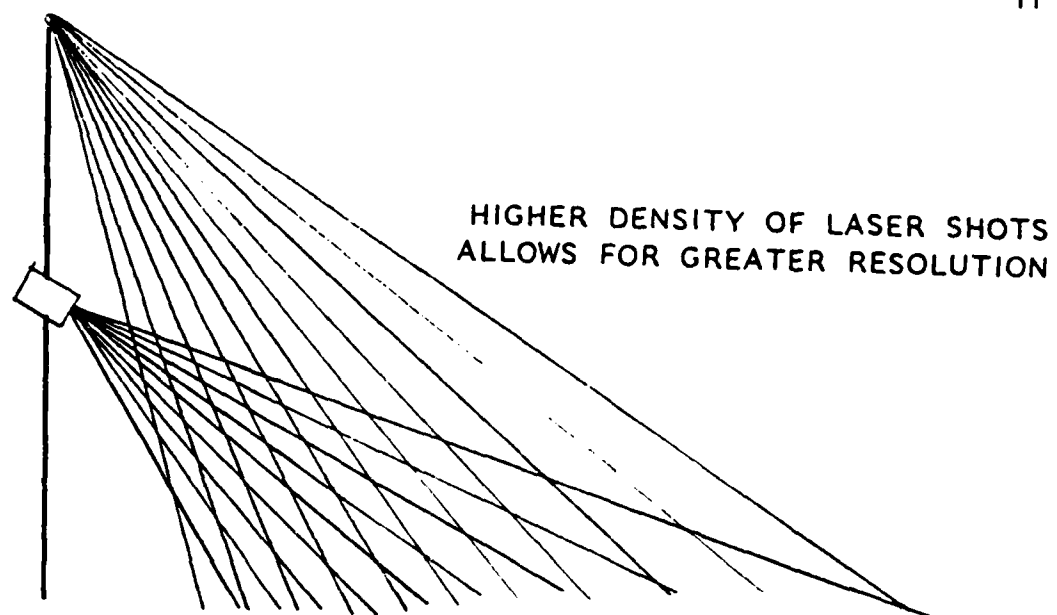
FIGURE 5. EFFECT OF LASER SHOT DENSITY ON RESOLUTION

DETECTOR

LESSER RESOLUTION DUE TO
REDUCED DISTANCE BETWEEN LASER AND DETECTOR

GREATER RESOLUTION DUE TO
INCREASED DISTANCE BETWEEN LASER AND DETECTOR
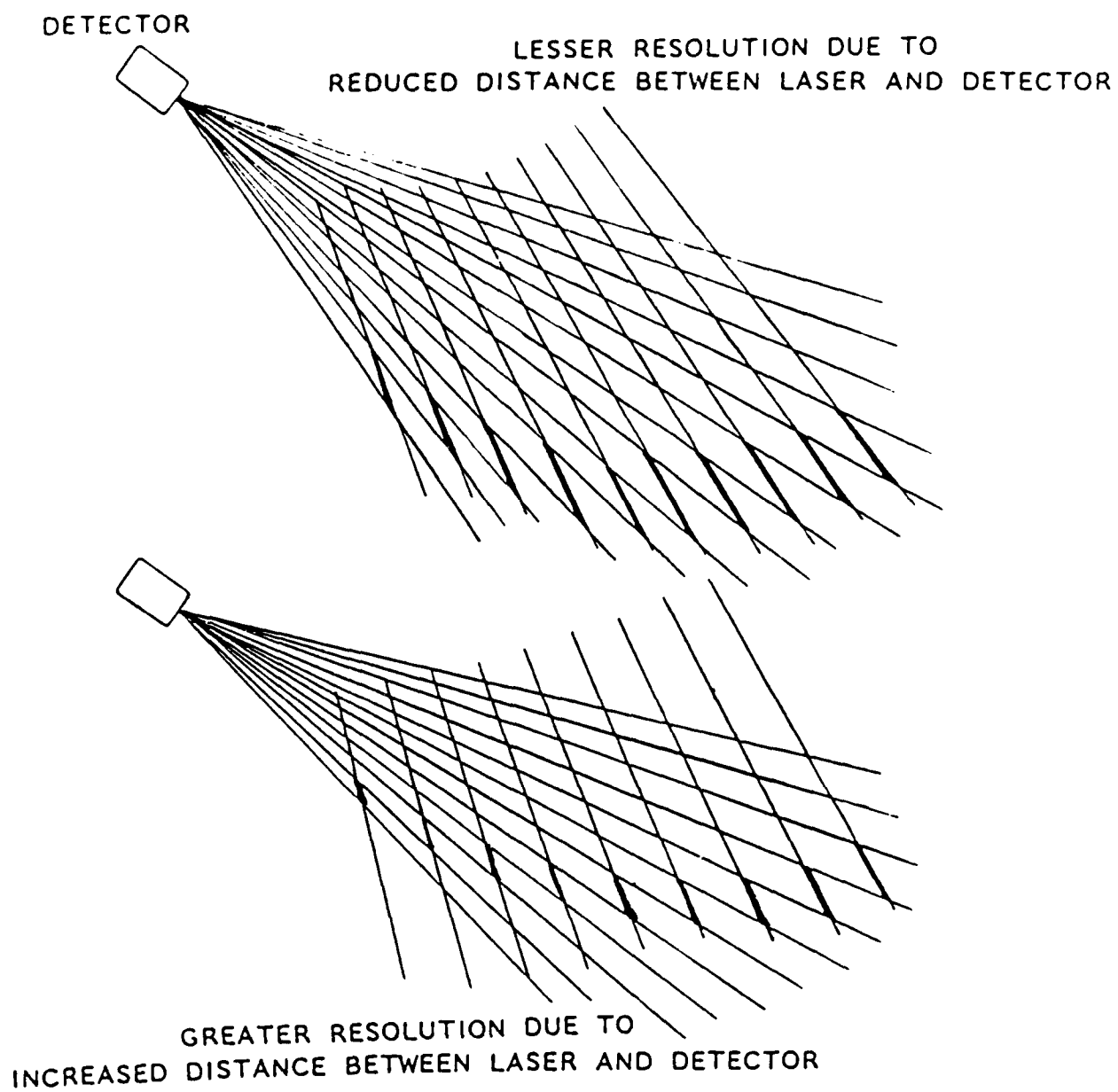
FIGURE 6. LASER/DETECTOR DISTANCE EFFECT ON RESOLUTION

2.1.2 Detector "Cone of Vision" Problem

A problem which arises from the application of this type of system is that the "cone of vision", which each detector possesses, unfortunately causes not a point, but a line segment of data to be considered a return for each detector. This problem, as illustrated in Figure 7 for step hazards and Figure 8 for slope hazards, is considered to be quite important in the determination of what is and what is not a hazard. For instance, if a step hazard is defined to exist whenever a step exceeds 25 cm (10 inches), but the system has a resolution of only 5 cm (2 inches) as a result of the "cone of vision" effect, it would be necessary to treat any hazard greater than 20 cm. (8 inches) as hazardous just to be safe. By the same token, if the system had a 5 degree angular resolution and a slope hazard is defined as any slope grade of greater than 30 degrees, then a slope encountered with a grade of 25 degrees must be treated as a hazard.

2.1.3 Laser Triangulation Justification

The justification for laser triangulation, as opposed to some other method to determine obstacle height and range, is the faster rate at which the obtained data can be analyzed. This is due, partly, to the fact that the single scan bit rate is only:

$$B = N(L) * LOG_2(N(L)) * LOG_2(N(D))$$
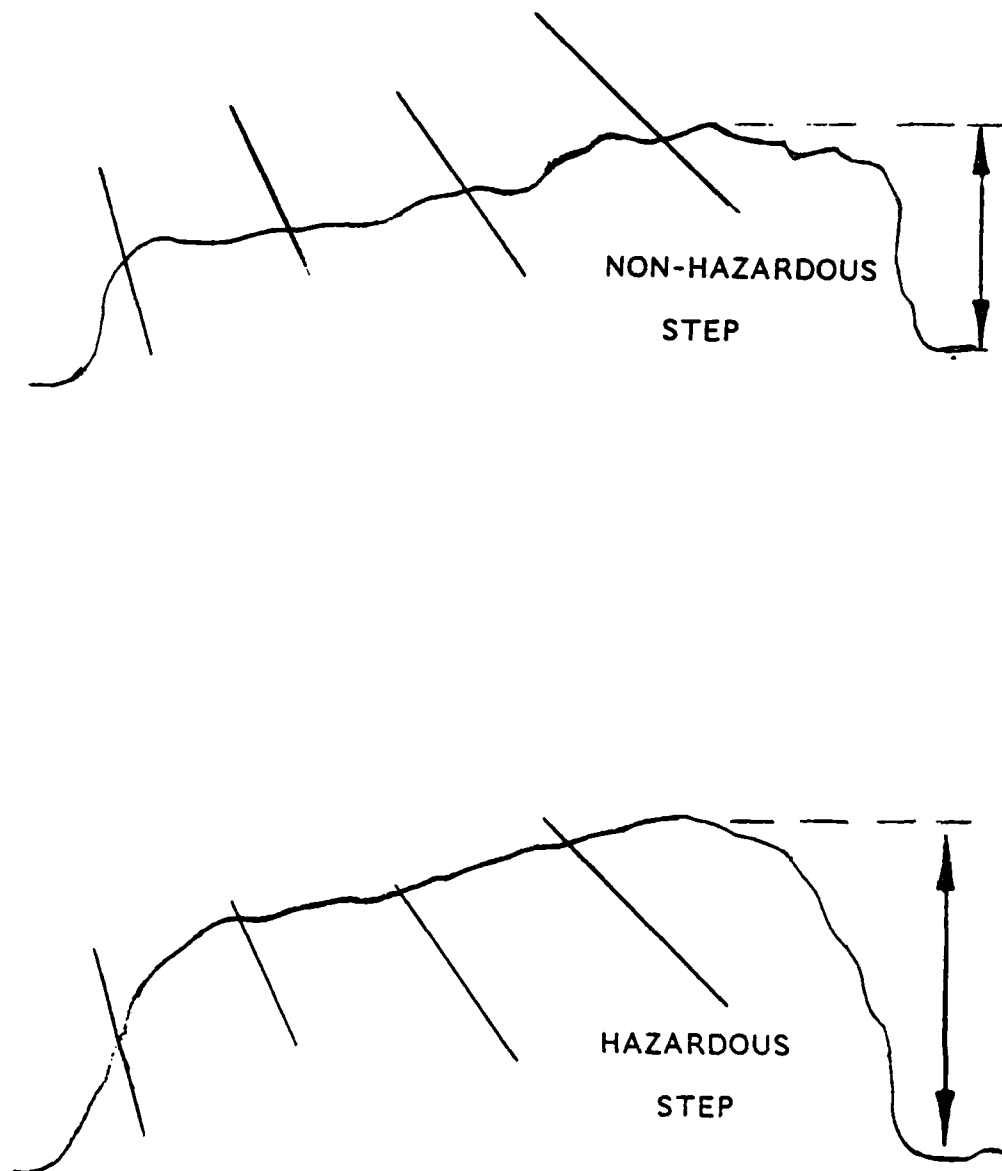
FIGURE 7. "CONE OF VISION" EFFECT ON STEP HAZARDS
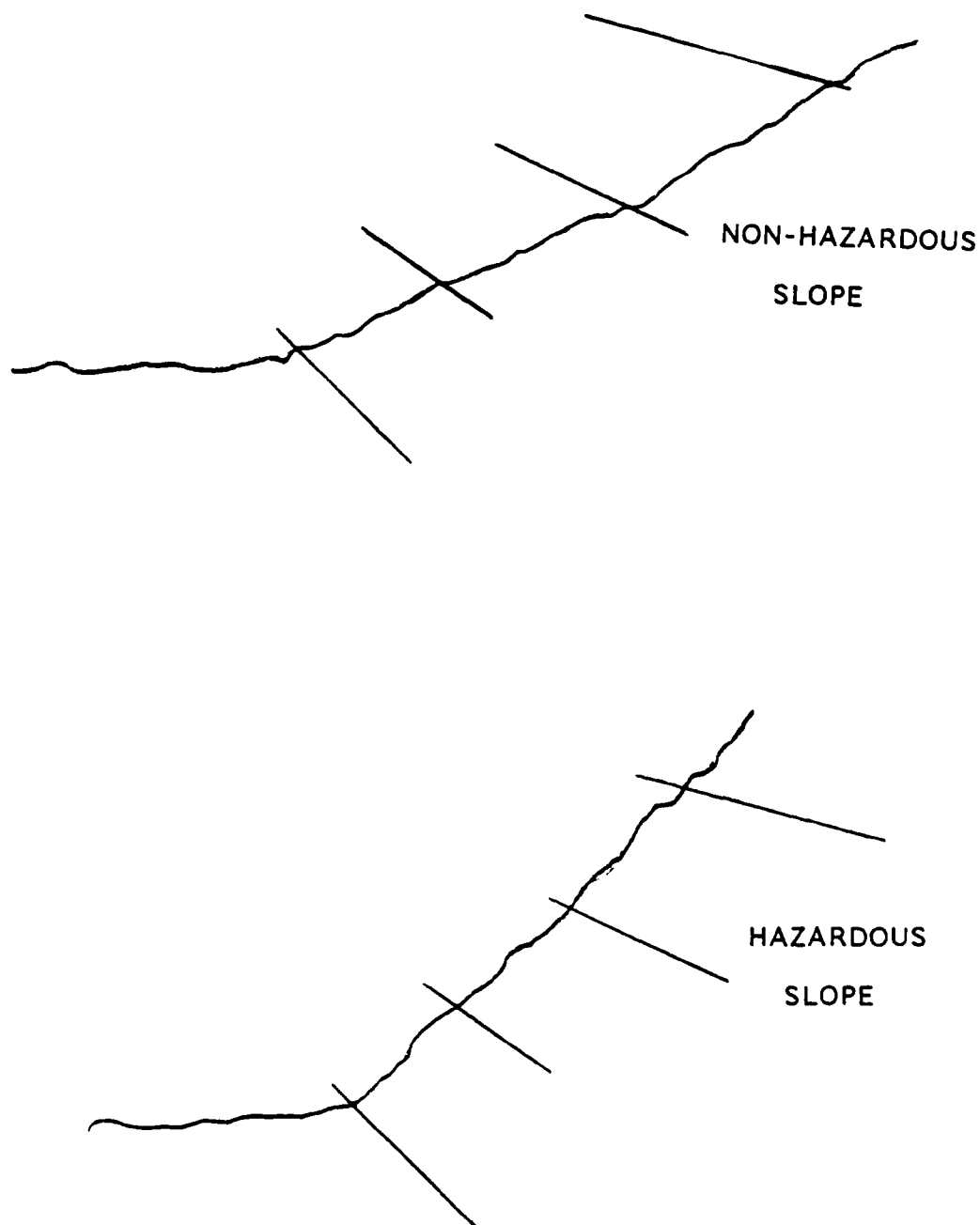
FIGURE 8. "CONE OF VISION" EFFECT ON SLOPE HAZARDS

where:

B is the number of bits per scan

N(L) is the number of laser shots fired

N(D) is the number of detectors used

For instance, if there were 1024 laser shots fired per scan and 64 detectors used, the number of bits required would be 1024*10*6 or 61440 bits per scan. If a scan were to occur once every 3 seconds, this would require data to be processed at a rate of about 20000 bits per second which can be handled quite easily, even by some microprocessors. For comparison, digitized voice processing requires an even higher rate. Another advantage which a laser triangulation system has over other systems is that each laser shot fired is tagged, meaning that each shot is fired at known azimuth and elevation angles. The advantage that this provides is that with known detector angles the determination of the height and range are a matter of plugging all of this information into a simple geometric equation.

What has not been attacked are the drawbacks which laser triangulation has. For instance, the resolution of a laser triangulation system is usually limited. Increasing the density of laser shots as well as increasing the number of detectors would increase it. Unfortunately, either one of these fixes would also increase the number of bits required to obtain a complete scan. In the case of the

Mars Rover vision system, these problems do not apply because a high resolution is not required.

2.2 Concept of the Scanning Laser

The Multi-Laser/Multi-Detector (ML/MD) vision scanning system works by firing a single laser through a series of elevations and azimuths and then receiving the reflections from the terrain back upon an array of detectors. By using a single fixed position laser firing at a rotating mirror, the cost and weight of the system are greatly held down. Also, the complexity of the drive electronics is reduced as only a single laser need be contended with. In addition, the amount of calibration required for the system is slight. If a rotating mirror is used, as in the case of the RPI Mars Rover, the mirror should be positioned with respect to a shaft encoder. This way, any elevation angle within the resolution of the encoder is available.

2.3 ML/MD Vision System Data Interpretation

The data obtained by an ML/MD vision system must be interpreted somehow. If what was described above with respect to the resolution was enough to completely describe a given terrain, then all that is necessary would have been said. But, there are other factors which have not, as yet, been pointed out. The most obvious of these

is that the information obtained must be interpreted with respect to the orientation of the vehicle. This information could be provided by gyroscopes giving the relative pitch and roll of the vehicle. For instance, if the vehicle were on an up-slope, then steps of lower magnitude than those acceptable when the vehicle is on flat ground would be tolerable. This is illustrated in Figure 9.

Another factor that must be considered is what to do about laser shots fired for which there are no detected returns. Two examples of this are shown in Figure 10. As can be seen in each of these Figures, the unknown terrain may or may not be hazardous. Because of this ambiguity, it must be assumed that whenever there are no returns, the unknown terrain is hazardous. This means that even with no returns, there is information conveyed, specifically that there is a hazard present.

The programs which do these interpretations are not the subject of this paper. They are mentioned merely for completeness. Only the modeler will be discussed later in any detail. Information about how this software works is available in References 4, 9, and 10.

LEVEL GROUND - 0.25 METER BLOCK
MAXIMUM VEHICLE SLOPE = 8 DEGREES

19 DEGREE SLOPE - 0.25 METER BLOCK
MAXIMUM VEHICLE SLOPE = 27 DEGREES

20 DEGREE SLOPE - 0.12 METER BLOCK
MAXIMUM VEHICLE SLOPE = 24 DEGREES

24 DEGREE SLOPE - 0.12 METER BLOCK
MAXIMUM VEHICLE SLOPE = 28 DEGREES

25 DEGREE SLOPE - 0.06 METER BLOCK
MAXIMUM VEHICLE SLOPE = 27 DEGREES

29 DEGREE SLOPE - 0.06 METER BLOCK
MAXIMUM VEHICLE SLOPE = 30 DEGREES

FIGURE 9. INCREASING SLOPE EFFECT ON STEP HAZARDS

MISSING RETURNS
BECAUSE OF ROCK
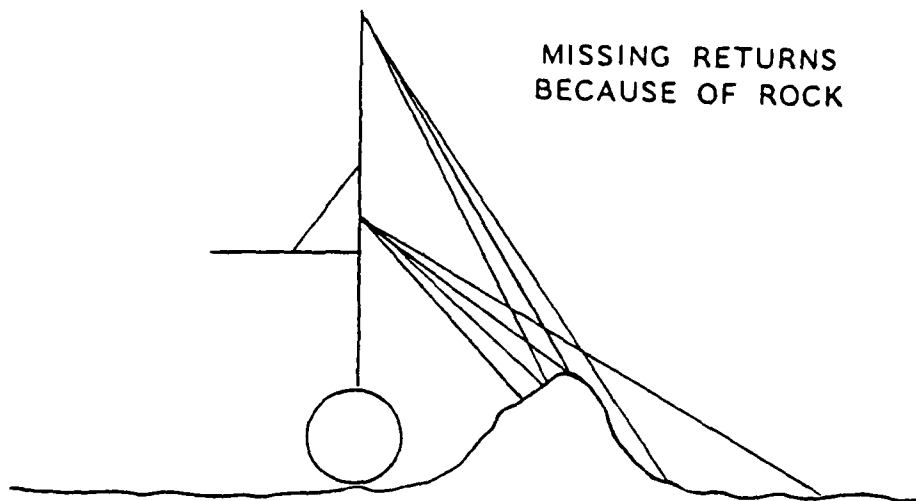
MISSING RETURNS
BECAUSE OF HILLTOP
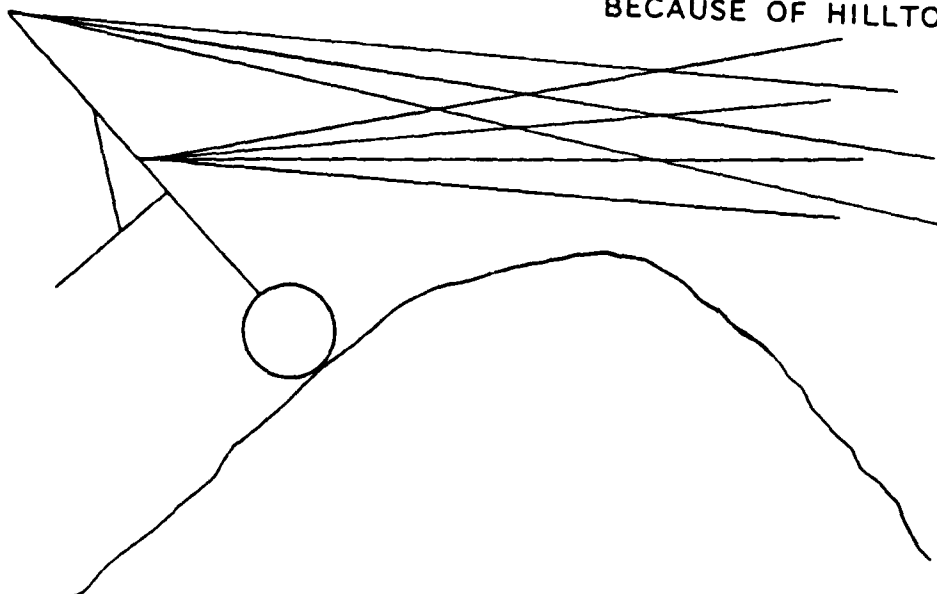
FIGURE 10. EXAMPLES OF MISSING RETURNS

PART 3

OVERVIEW OF VISION SYSTEM

Before the test results of the RPI Mars Rover vision system are discussed, an overview of the vision system's hardware and software components will be given. Figure 11 presents this system in a block diagram form. The separate components are described in detail below.

3.1 Mast and Associated Electronics

The electronic hardware used on the vision system for the Rensselaer Mars Rover consists of several components. The laser and the detector array are housed in the rotatable mast. The semiconducor laser is capable of producing infrared light pulses with a wavelength of 904 nm and a peak power of 100 watts at a 10000 hertz rate with a .04 percent duty cycle. The light from the laser is focused by a lens and then reflected from a rotating 8-sided mirror. This reflected light then hits the terrain. Some portion of whatever light reflected from the terrain passes through the 35 mm camera lens and onto a photodetector diode array. The photodiode array consists of 20 photodiodes with a common cathode mounted in a 20 pin DIP (Dual Inline Pin) package.

21
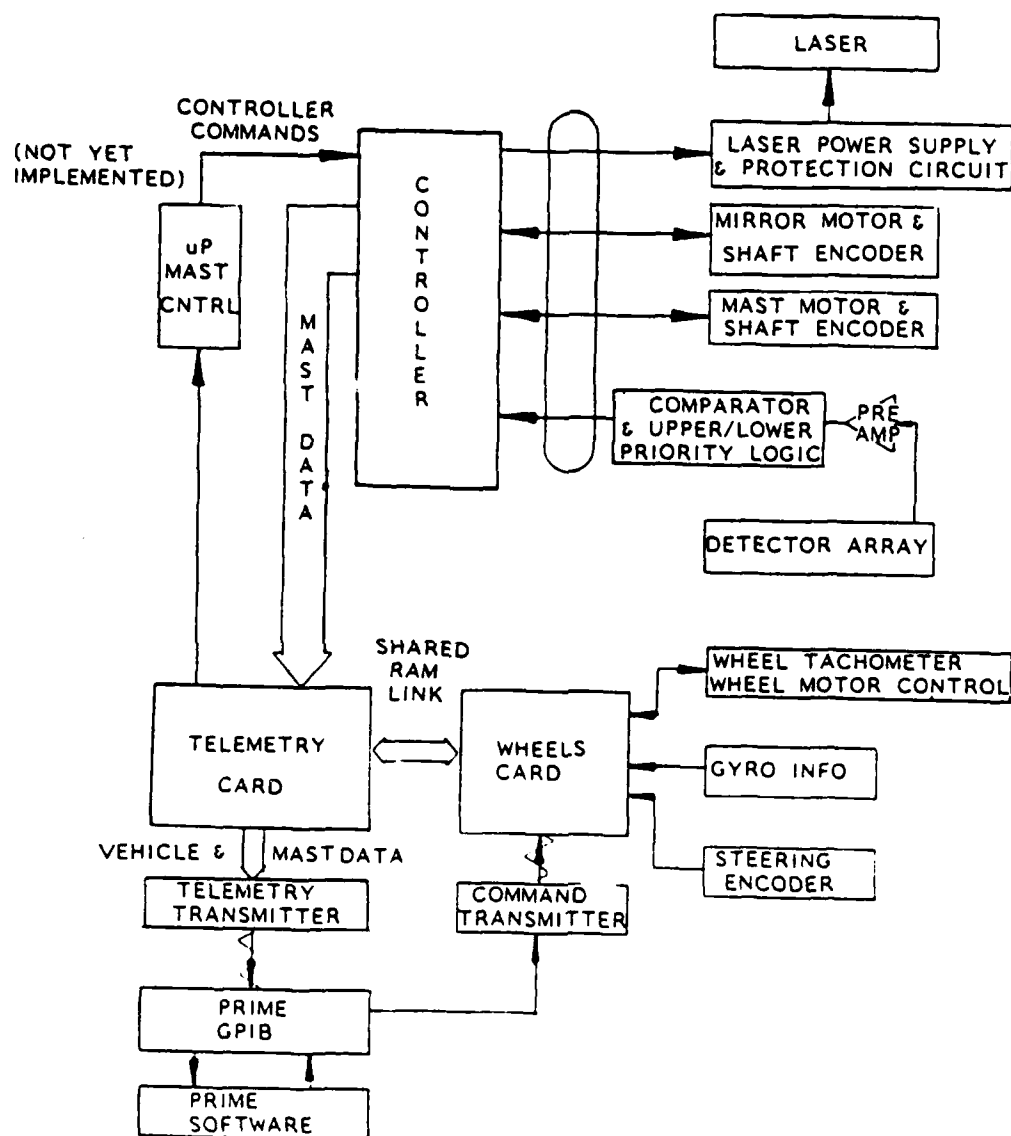
FIGURE 11. BLOCK DIAGRAM OF VISION SYSTEM

Each photodiode is connected to an integrated circuit operational amplifier. Comparators then determine whether or not a particular photo-diode received any of the return light and the upper and lower detector numbers of those hit are determined. These numbers are fed through slip rings to the control circuitry in the non-rotating back of the mast (see Reference 11). The mast is shown in Figure 12.

The rotation of the mast, the rotation of the 8-sided mirror, and the timing for firing the laser are controlled by electronics on five circuit cards located on the back of the mast (see References 3 and 7). These cards are supplied the position of the rotating mirror by a shaft encoder which puts out 2048 pulses per revolution along with a zero pulse. The information makes available 256 different elevation angles between 0 and 90 degrees (8 times per revolution of the mirror). There is also a shaft encoder which identifies the azimuth position of the mast. This encoder allows up to 256 different azimuth angles; some of which cannot be used because they occur in the back of the scan. When a laser pulse is fired, 32 bits of information are shifted into FIFO (First-In-First-Out) memories. These are end of scan, end of azimuth, azimuth number, elevation number, upper detector returned number, and lower detector returned number.
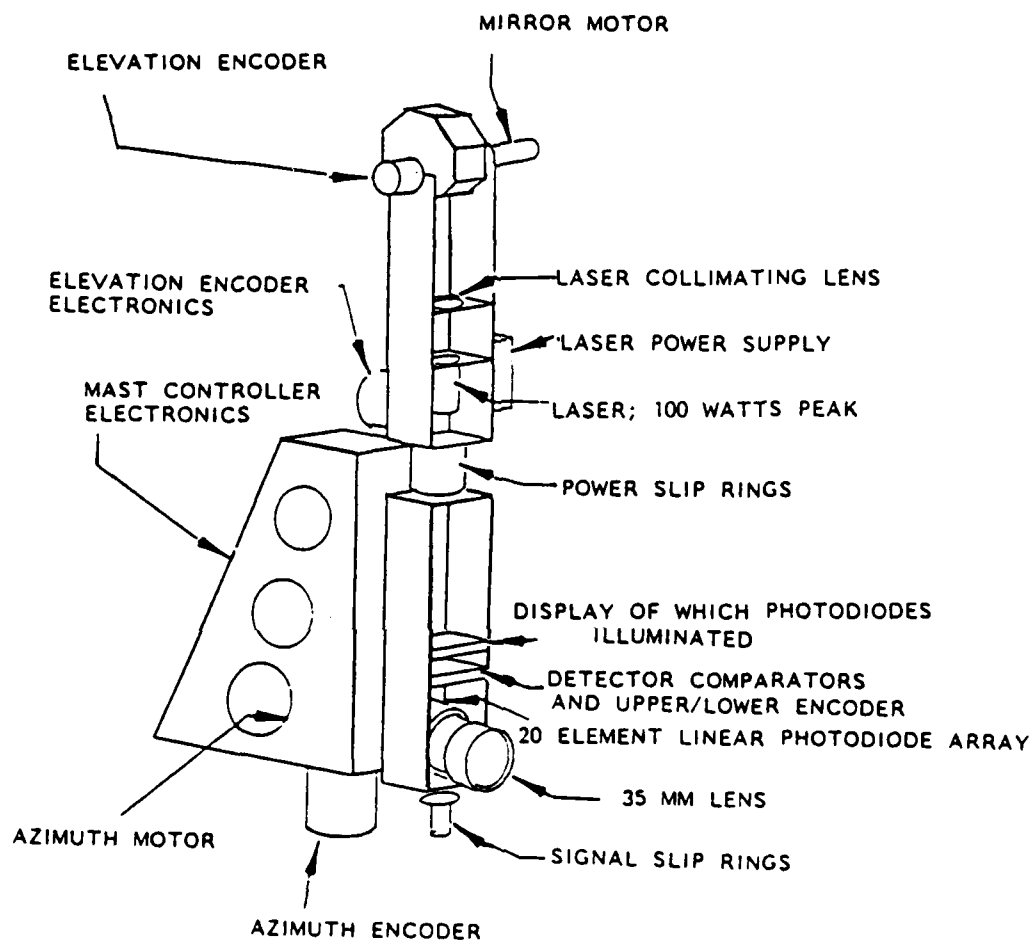
FIGURE 12. MULTI-LASER/MULTI DETECTOR MAST

3.2 Telem card

All of the data shifted into the FIFOs, as well as the data describing the vehicle's current status must be buffered and sent to the computer running the realtime control routines. The vehicle status data includes information on the wheel speeds, the gyro angles, and the steering angle. This is done by the telemetry stand-alone microprocessor board located in the vehicle card cage (see Reference 2). The program TELEM6.TC currently runs the processor. This program acts as both a diagnostic tool as well as a data flow controller. It's output display, shown in Figure 13, tells immediately if there are any major faults with the data coming from the mast. When a period is printed, vehicle data for a particular scan has just been sent. The number shown to the left of each colon is an azimuth number and the number shown to the right of the colon is the number of elevation shots fired for that particular azimuth. At the end of scan 'EOS' is printed, as well as the number of azimuths and the total number of laser shots fired. Any deviation from the defined laser shot numbers can easily be detected from this displayed output. A listing of TELEM6.TC can be found in Appendix Section 7.1.

```
:::::,,00:32.01:32.02:32.03:32.04:32.05:32.06:32.07:32.08:32.09:32.10:32.11:32.
12:32.13:32.14:32.15:32.16:32.17:32.18:32.19:32.20:32.21:32.22:32.23:32.24:32.25
:32.26:32.27:32.28:32.29:32.30:32.31:32
                    EOS 32 1024

:::::,,00:32.01:32.02:32.03:32.04:32.05:32.06:32.07:32.08:32.09:32.10:32.11:32.
12:32.13:32.14:32.15:32.16:32.17:32.18:32.19:32.20:32.21:32.22:32.23:32.24:32.25
:32.26:32.27:32.28:32.29:32.30:32.31:32
                    EOS 32 1024

:::::,,00:32.01:32.02:32.03:32.04:32.05:32.06:32.07:32.08:32.09:32.10:32.11:32.
12:32.13:32.14:32.15:32.16:32.17:32.18:32.19:32.20:32.21:32.22:32.23:32.24:32.25
:32.26:32.27:32.28:32.29:32.30:32.31:32
                    EOS 32 1024

:::::,,00:32.01:32.02:32.03:32.04:32.05:32.06:32.07:32.08:32.09:32.10:32.11:32.
12:32.13:32.14:32.15:32.16:32.17:32.18:32.19:32.20:32.21:32.22:32.23:32.24:32.25
:32.26:32.27:32.28:32.29:32.30:32.31:32
                    EOS 32 1024
```

FIGURE 13. OUTPUT FROM TELEMETRY PROCESSOR CARD

3.3 Prime GPIB

The data which the telemetry board handles is sent via two coaxial cables to a PRIME 750 in the RPI Image Processing Lab, JEC Room 2318. The data enters the Prime via a GPIB (General Purpose Interface Board) (see Reference 5). This board controls a DMT (Direct Memory Transfer) into the main memory of the Prime computer. The board itself is controlled by the device driver T$ROVR (see Reference 12).

3.4 Prime Computer Programs

There are basically three types of routines which use the data once it has made its way into the Prime Computer. The first of these routines are the realtime routines which take given data, determine what hazards exist, and decide what the Rover should do next; stop, turn, go, etc. As of the time this paper was written, the actual path selection routines on what the Rover's next move should be have not been used in realtime. However, they have been used in simulation (see Reference 10). In addition to the realtime routines, there are the post processing routines. These routines allow the user to look at the data. In fact, the various graphs in this paper were produced using the post-processing routines. A descriptive list of the names and particular functions of these routines can be found in the project report MP-80 (Reference 9).

The third type of routines are used for mast calibration. This routine is actually a form of a post-processor, but it is meant to be used only when, for some reason, some mast parameter needs to be changed. The calibration routines are especially useful in calibrating detector angles and elevations. Due to system limitations, it is almost impossible to make the detector's cone of vision identical for every detector, therefore, attempting to measure by hand the cone of vision's precise center for each detector also becomes an almost impossible task. Since the elevation angles at which the laser fires are known, detector calibrations can be achieved by feeding the mast known terrains at known slope angles. Since the only unknowns involved in obtaining this data are information relating to the detectors, these unknowns can be solved for. After several different slopes have been obtained, guaranteeing all detectors have received returns from more than a single laser elevation angle, a table of detector angles and heights can be created through linear regression (see Reference 9).

3.5 The Modeler

The heart of the realtime routines is the modeler. This is a subroutine which takes the given raw laser and detector data and produces a list of hazards for each scan. Then, it divides the hazard analysis into two catagories. The first of these is in-path hazard analysis. In-path hazard analysis detects hazards which exist along a

particular azimuth. These types of hazards are step hazards, slope hazards, and insufficient data hazards. The other type of hazard analysis performed is cross-path hazard analysis. These hazards are those created by two adjacent valid azimuths which when next to each other produce a hazard, but do not necessarily constitute hazards when found without the other.

3.5.1 What the Modeler Does with the Data

Although a complete description of how the modeler works will not be given here (see References 9 and 10 for more), a general flowchart as well as equations of particular interest are discussed below. The in-path analysis is done for each azimuth one at a time. The first process is changing the incoming upper/lower detector number inputs to index values. Next, they are placed in the order of increasing range. Points which could be the sources of sensor quantization errors as well as those considered too distant in range are removed. Finally, the actual analysis begins starting with the determination of whether there are enough returns or whether the most distant return is too close. The data used for cross-path hazard analysis is extracted at this time for later use. Slope and step hazard cataloguing follows. After all in-path analysis has been completed, cross-path analysis is applied. The cross-path analysis compares characteristics of adjacent azimuths with valid data to determine the presence of either a cross-slope or a cross-step hazard. Both

cross-slope and cross-step hazards are lumped together as cross-path hazards. When the cross-path analysis is complete, the work of the modeler is finished.

3.5.2 Modeler Slope Hazard Equations

The modeler determines the slopes in an azimuth by taking the arctangent of the height difference divided by the range difference for each pair of valid adjacent elevation shots. The key to the modeler's ability to detect a slope hazard is the following equations:

$$CS=(1-B)*ARCTAN((TZ(J)-TZ(J-1))/(TR(J)-TR(J-1)))+B*OLDCS$$
$$ESTSLOPE=AZSLOPE+CS$$

where for a particular azimuth:

J - counter from 2 to the number of valid laser returns.

CS - the current elevation pair unadjusted slope estimate.

OLDCS - the previously determined value of CS.

TZ() - height (z-axis) coordinate array for each elevation.

TR() - range coordinate array for each elevation.

AZSLOPE - the adjusted zero slope with respect to the planet's coordinates and vehicle orientation. This value is determined using gyro and azimuth number information.

ESTSLOPE - the estimated, adjusted slope determined for the current elevation pair. Whenever this value is greater than the slope threshold, a slope hazard is flagged.

B - a coefficient which determines how much of the previous will be used in the current slope determination. Its values ranges from -1 to 1.

Of the above mentioned parameters, the coefficient B has the greatest impact on the estimated slope value. It determines how much smoothing of the slope occurs by injecting B amount of the previous slope into the current slope. This smoothing action helps to distinguish slope hazards from step hazards since step hazards consist of relatively high frequency variations. This low pass filter effect can be quite dramatic as shown in the testing.

3.5.3 Modeler Step Hazard Determination

The modeler is set up to determine step hazards using three separate pieces of information. These are: actual height variations, vehicle orientation information, and slope information. The reason for the use these last two pieces of information may not seem obvious, but will be explained here. As was stated earlier in THEORY, the vehicle's ability to negotiate a step decreases as the presence of a slope in the same direction as the step increases, but not vice versa. Therefore, it is necessary for the slope values, determined by the above method, to be injected into the step hazard analysis.

3.5.4 Classification of Hazards

There are six types of hazards which are classified by the modeler: step hazards, slope hazards, insufficient data hazards, most distant return to close hazards, cross-path hazards, and bad data hazards. The first four of these are determined by analysis of data returned in a single azimuth. The cross-path hazards are determined by intra-azimuth analysis. A bad data hazard is usually the result of some hardware element of the system failing. A more in-depth description of each of these follows.

3.5.4.1 Step Hazards

A hazard in which wheels of the vehicle cannot properly maneuver is known as a step hazard. Examples of step hazards include protrusions, such as rocks, and depressions, such as holes. Since the wheel radius is 25 cm. (10 in), a height greater than this would not allow the vehicle's wheels to negotiate it. In the case of a hole deeper than 25 cm. (10 in), the wheels could certainly get in, but there would be no guarantee that they could get out again. Also, just because the wheel got into a hole doesn't mean that it did so undamaged.

3.5.4.2 Slope Hazards

A slope hazard is defined as a hazard whose slope is greater than that which the vehicle can properly negotiate. An example of this type of hazard is hilly terrain. The nature of the dangers slope hazards present can be quite complicated. For instance, the vehicle might be on a progressively steeper hillside (as in Figure 14A). If the change is very gradual, the scanning laser, alone, will not notice the change. The other parts of the system, specifically the gyros, would be depended upon to supply the missing information. However, the ML/MD system is necessary for recognizing the presence of a sharp slope hazard before the vehicle actually encounters it. An example of such terrain is shown in Figure 14B.

3.5.4.3 Insufficient Data

When, for some reason, less than one-fourth of the total number of laser shots for an azimuth have returns accounted for, an insufficient data hazard is flagged. The reasons for not enough data being returned range from encountering a terrain with poor reflective properties to hardware failures.

The reflective properties of materials vary from excellent to terrible. As was determined (see Reference 9), the amount of light returned from such materials as black slate was not detected by the

HAZARD RECOGNIZED
BY VISION SYSTEM

B

HAZARD RECOGNIZED
BY GYROSCOPE

A
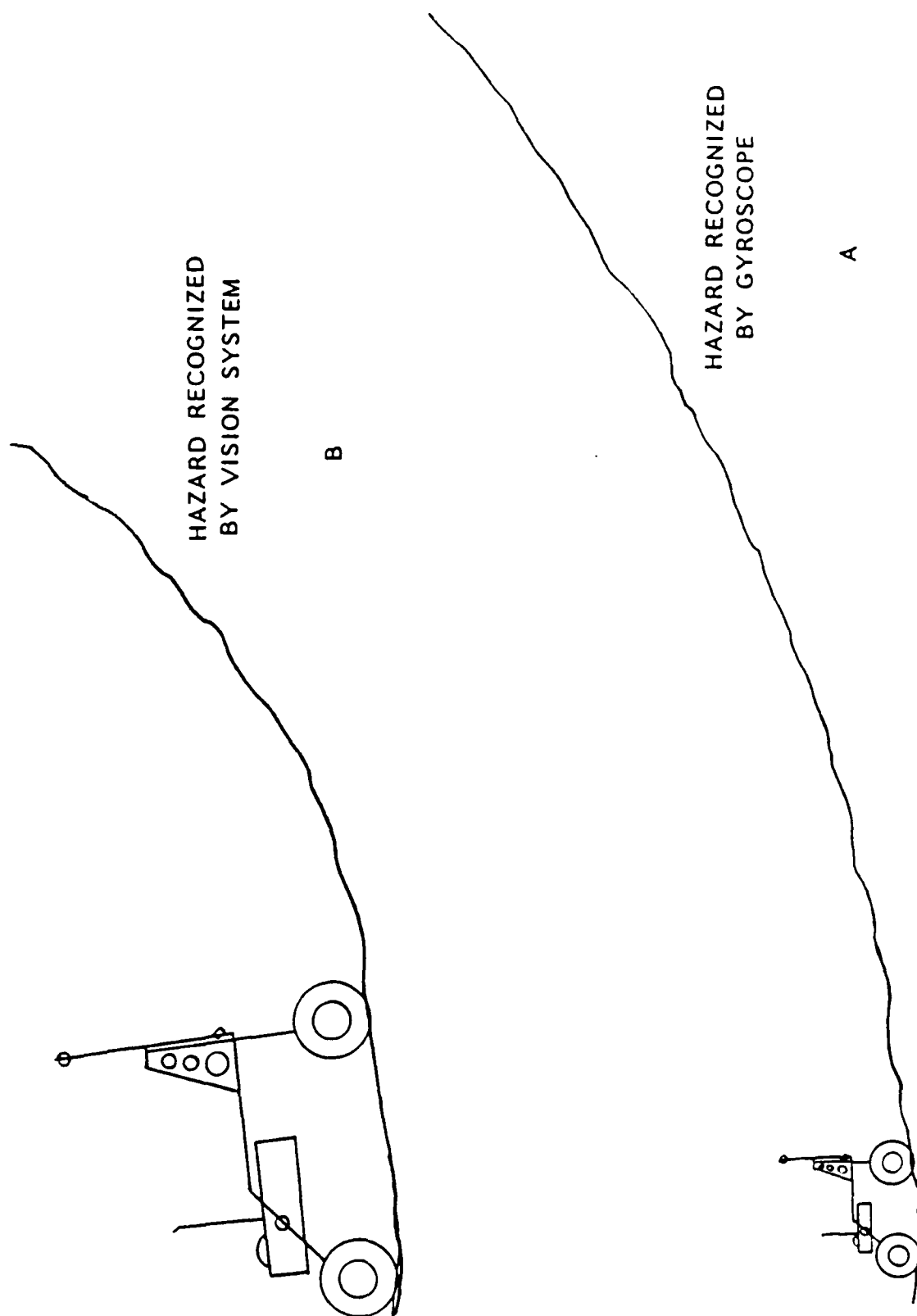
FIGURE 14. VEHICLE APPROACHING DIFFERING SLOPE GRADES

detectors at any range with any aperture settings. The most likely explaination for this occurance is that the black slate in question simply absorbed all, or almost all, incident infrared light on its surface. On the other hand, a material like brown cork reflected more light than black slate but less than wood. What this indicates is that different materials reflect infrared light differently. A material such as dry garden dirt, whose reflective ability was analyzed this year, reflects slightly better than the light brown cardboard analyzed last year. In any case, the poor reflective properties of a material could certainly account for an insufficient data hazard.

Hardware failures, given the number and complexity of components in a system like this, are almost inevitable. A particular problem which has crept up occasionally has been detector amplifier oscillations. Because returns are considered invalid when the upper and lower detector numbers differ by more than 1, an oscillation in a particular detector amplifier will cause most of the data from that scan to be disqualified resulting in an insufficient data condition.

3.5.4.4 Farthest Return Less Than 1.5 meters Away

When the terrain is such that the furthest laser return in a particular azimuth is less than 1.5 meters, the terrain further than this is classified as unknown and is automatically assumed to be hazardous. The reason this is flagged as a special hazard is that the

vehicle would have to back up to avoid anything that was any closer. Thus, this type of hazard must also be avoided.

3.5.4.5 Crosspath Hazards

A cross path hazard is defined to be an occurence of 2 adjacent azimuths where, alone, the terrains do not necessarily constitute a hazard. But, when the terrains are next to each other, a hazard results. Both slope and step hazards are classified as crosspath hazards when either is encountered during crosspath analysis. However, the criterion for determining whether or not a slope or step hazard is present is more rigorous than the criterion applied for in-path analysis. This is because of the filtering which takes place before the crosspath analysis. The result is that it is possible for a certain terrain to be flagged with a crosspath hazard if the mast were viewing it from one angle, but would not register with a hazard when viewed from another angle. A typical crosspath hazard would be a boulder edge encountered in one azimuth and a hole encountered in an adjacent azimuth. This is depicted in Figure 15.

15 CM.

15 CM.

GROUND VIEW
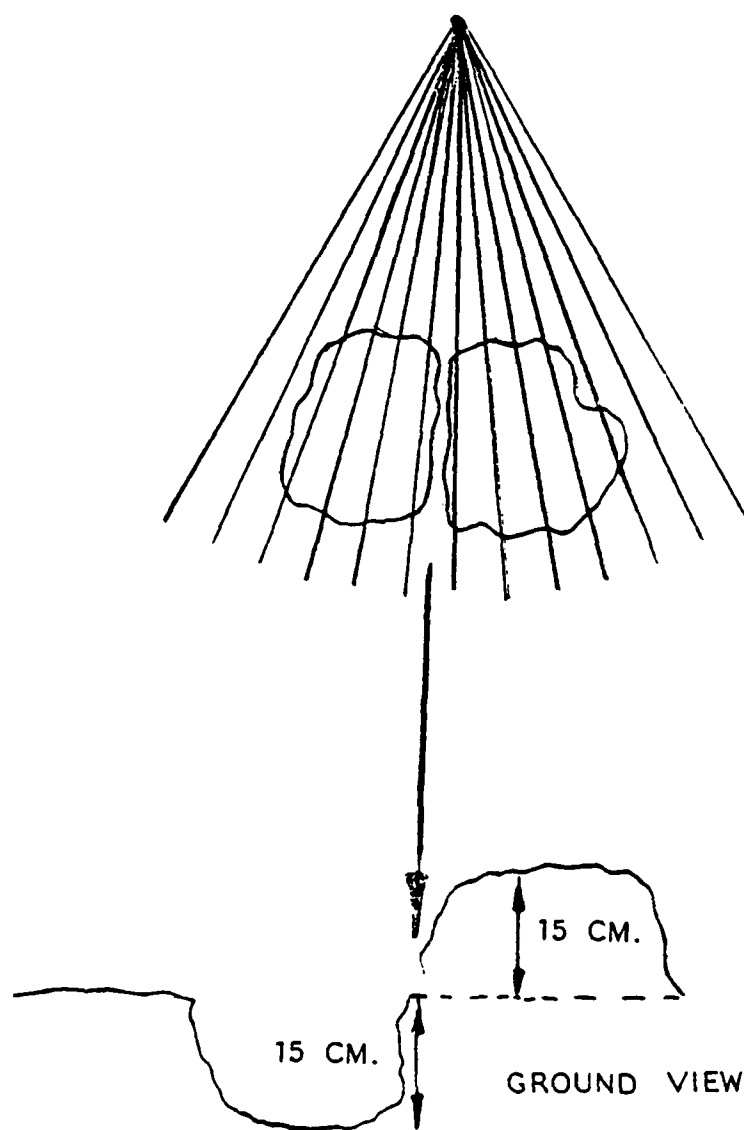
FIGURE 15. CROSS PATH HAZARDS

3.5.4.6 Bad Data

If the data obtained from the mast can not be interpreted, then another type of hazard must be catalogued. This type of hazard would occur if there was illegal or improper information supplied to the modeler compared to what is expected. For instance, there are supposed to be 32 azimuths, but, if for some reason 33 azimuths were fired, a bad data error would be flagged. The same is true if the number elevations fired differed from the number expected for a particular azimuth. A bad data error could be attributed to either a hardware failure, setting up the realtime software parameters with no consideration of the actual hardware used, or both. Bad data also raises questions concerning the reliability of theof the received data. As all bad data is thrown out, consistently bad data means that the Mars Rover vehicle would have to be commanded to stop until the bad data problem is solved.

PART 4

TESTING PROCEDURES

All testing was performed indoors on a concrete floor at a room temperature of approximately 23 degrees Centigrade (74 degrees Fahrenheit). The mast was rotating at approximately 16 revolutions per minute with the laser firing 32 azimuths each with 32 elevations. The azimuth and elevation firing angles used can be found in the tables in Figure 16. For all tests, the lens aperture was opened to 5.6 and the lens focus setting was .45 meters (note that this does not correspond to the settings on a camera since location of the photodiode array does not correspond to where the film would have been). The mast pitch and roll were each 90 degrees. The ground, for all tests except for the hole tests was 36 cm (14 in) below vehicle ground. With this in mind, the effective detector heights was 1 meter above vehicle ground and the effective laser height was 2 meters above vehicle ground. The data was collected using the program RECV2, it was run through the modeler using EXEC.POST2, and the graphs were generated using VIEW.MDL (for an explanation of these programs, see Reference 9).

Azimuth Number	Angle (degrees)	Elevation Number	Angle (degrees)
1	-43.56	1	23.56
2	-40.74	2	24.61
3	-37.93	3	25.66
4	-35.13	4	26.71
5	-32.31	5	27.76
6	-29.50	6	28.80
7	-26.69	7	29.85
8	-23.88	8	30.90
9	-21.08	9	31.95
10	-18.26	10	33.00
11	-15.45	11	34.05
12	-12.64	12	35.10
13	-9.84	13	36.15
14	-7.02	14	37.19
15	-4.22	15	38.24
16	-1.41	16	39.29
17	1.40	17	40.34
18	4.21	18	41.39
19	7.02	19	42.44
20	9.83	20	43.49
21	12.64	21	44.54
22	15.45	22	45.59
23	18.26	23	46.63
24	21.07	24	47.68
25	23.88	25	48.73
26	26.69	26	49.78
27	29.50	27	50.83
28	32.31	28	51.88
29	35.12	29	52.93
30	37.93	30	53.98
31	40.74	31	55.03
32	43.55	32	56.07

TABLE OF AZIMUTH ANGLES   TABLE OF ELEVATION ANGLES

FIGURE 16. TABLES OF AZIMUTH AND ELEVATION ANGLES

Terrains were created using cardboard sheets and boxes with reflective properties similar to those of dry dirt. It should be noted that detectors 6 and 11 were not functioning at the time of testing.

4.1 Single Step Tests

The first type of hazards tested for were step hazards. A rectangular (66 by 61 cm (26 by 24 in)) step was placed approximately 1 meter in horizontal distance from the front of the mast. There were 8 different step levels tested using heights from 5 cm to 45 cm (2 to 18 inches) in 5 cm (2 in) increments. The step size which was defined in the modeler to be a step hazard was 25 cm (10 in). The resulting graphs and data descriptors for heights of 20, 25, and 30 cm. (8, 10, and 12 in) are shown in Figures 17, 18, and 19. As can be seen, a step hazard was flagged at the desired step threshold height. Also, the height determined was very close to the actual height of the obstacle.

4.2 Slope Tests

Because the values of the slope coefficient B and the slope threshold determine how the modeler interprets the data, with respect to slope hazards, the parameters were varied to demonstrate the modeler's reactions. The test itself consisted of placing a ramp 183 cm long by 66 cm wide (72 by 26 in) in front of the mast. The distance

Input file: MDL.STEP.08
File Creation Date : WED, JUL 27 1983   System time   16:15:17

**   MODEL1 PARAMETERS   **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT   =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

```
2.0 +
    |                              . .
    |                                . .
    |                   . .              .
    |                                  .
1.0 +                      .
    |                    . .           .            X vs. Y for
    |              . .          .           . .      hazards of
    |            .          .            .            scan #  1
    |
0.0 +            .          .            .           Number key:
    |                       .            .           1 -- Insufficient data
    |              . .          .            .        2 -- Furthest return .LT. 1.5m
    |            . .         .            . .        3 -- Slope hazard
    |                      . .                        4 -- Step  hazard
-1.0 +              .           .                     5 -- Crosspath hazard
    |                      . .          . .          6 -- Bad data
    |            •. .                  . .
    |
    |                      . .
-2.0 +
    ------------------------------------------> X
    0         1         2         3         4        Points off scale:   0
```

NO HAZARDS CATALOGED THIS SCAN

FIGURE 17. 20 CM STEP TEST

Input file: MDL.STEP.10
File Creation Date : WED. JUL 27 1983   System time   16:26:48

** MODEL1 PARAMETERS **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	1.29	1.27	-0.22	-0.37	Step hazard
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	N O	H A Z A R D S	C A T A L O G E D		
16	1.41	N O	H A Z A R D S	C A T A L O G E D		
17	1.40	1.29	1.29	0.03	-0.37	Step hazard
18	4.21	1.29	1.29	0.09	-0.37	Step hazard
19	7.02	1.29	1.28	0.16	-0.37	Step hazard
20	9.83	N O	H A Z A R D S	C A T A L O G E D		
21	12.64	1.29	1.26	0.28	-0.37	Step hazard
		1.61	1.57	0.15	0.14	Step hazard
		1.75	1.74	0.08	-0.10	Crosspath hazard
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

FIGURE 18. 25 CM STEP TEST

Input file: MDL.STEP.12
File Creation Date : WED, JUL 27 1983   System time   14:05:35

** MODEL1 PARAMETERS **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	1.37	1.35	-0.23	-0.34	Step hazard
		1.45	1.43	-0.25	-0.32	Step hazard
14	-7.02	1.33	1.32	-0.16	-0.36	Step hazard
		1.37	1.36	-0.17	-0.35	Step hazard
		1.45	1.44	-0.18	-0.32	Step hazard
15	-4.22	1.29	1.29	-0.09	-0.37	Step hazard
		1.37	1.36	-0.10	-0.36	Step hazard
		1.45	1.44	-0.11	-0.32	Step hazard
16	-1.41	1.33	1.32	-0.03	-0.36	Step hazard
		1.37	1.37	-0.03	-0.35	Step hazard
		1.41	1.41	-0.03	-0.34	Step hazard
17	1.40	1.37	1.37	0.03	-0.34	Step hazard
		1.41	1.41	0.03	-0.33	Step hazard
18	4.21	1.33	1.32	0.10	-0.36	Step hazard
		1.37	1.36	0.10	-0.35	Step hazard
		1.45	1.44	0.11	-0.32	Step hazard
19	7.02	1.29	1.28	0.16	-0.37	Step hazard
		1.37	1.36	0.17	-0.36	Step hazard
		1.45	1.44	0.18	-0.32	Step hazard
20	9.83	1.37	1.35	0.23	-0.34	Step hazard
		1.41	1.39	0.24	-0.33	Step hazard
21	12.64	1.33	1.29	0.29	-0.36	Step hazard
		1.41	1.37	0.31	-0.34	Step hazard
		1.38	1.35	0.41	-0.09	Step hazard
22	15.45	1.41	1.36	0.37	-0.34	Step hazard
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

FIGURE 19. 30 CM STEP TEST

from the mast to the start of the ramp was 1 meter. The height at one end was held fixed while the height at the other end the height was varied from 16 cm to 118 cm (6 to 46 in) in 7 equal steps. This corresponds to angular variation of from 5 to 40 degrees. Slopes with angles of 20, 25, 30, and 35 degrees are shown in Figures 20, 21, 22, and 23 with the modeler coefficient set to B=.90 and a slope threshold set to 30 degrees. Figures 24, 25, 26, and 27 depict the results for the same angles and slope threshold, but with a modeler coefficient of B=.85. Results for other values of B as well as different slope thresholds are given in Appendix Section 7.2.2.

4.3 Two Obstacles Tests

The side to side resolution of the vision system was tested by placing 2 similiar obstacles next to each other at equal distances from the mast. One of these obstacles had a top area of 61 by 61 cm (24 by 24 in) and a fixed height of 36 cm (14 in). The other had a top surface 66 by 61 cm (26 by 24 in) and a height which was adjusted from 0 cm to 40 cm (0 in to 16 in). Both always had their closest edge at a fixed radius of 1 meter from the mast. The purpose of this test was to determine the ability of the system to distinguish between a hazard and a non-hazard right next to it.

When the height of the varying hazard was 10 cm or less, there should be a hazard recorded on both sides of the fixed hazard.

Input file: MDL.SLOPE.20.30.90
File Creation Date : THU, AUG 11 1983   System time   19:26:15

            ** MODEL PARAMETERS **
        HEIGHT FILTER COEFFICIENT   0.25
        SLOPE FILTER COEFFICIENT   0.90
        LEVEL GROUND STEP THRESHOLD =   0.25 METERS
        SLOPE THRESHOLD =   30.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	N O	H A Z A R D S	C A T A L O G E D		
16	-1.41	N O	H A Z A R D S	C A T A L O G E D		
17	1.40	N O	H A Z A R D S	C A T A L O G E D		
18	4.21	N O	H A Z A R D S	C A T A L O G E D		
19	7.02	N O	H A Z A R D S	C A T A L O G E D		
20	9.83	N O	H A Z A R D S	C A T A L O G E D		
21	12.64	2.04	1.99	0.45	-0.01	Step hazard
		2.25	2.20	0.49	-0.01	Crosspath hazard
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

FIGURE 20. 20 DEGREE SLOPE TEST WITH B=.90

Input file: MDL.SLOPE.25.30.90
File Creation Date : THU, AUG 11 1983   System time   19:28:08

** MODELL PARAMETERS **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

```
2.0 +                        . .
    |                          . .
    |                   . .      .
1.0 +                . .          .       X vs. Y for
    |                              .       hazards of
    |            . .    . .         . .    scan #  1
    |                 4    .          .
0.0 +          .                      .    Number key:
    |          .                      .    1 -- Insufficient data
    |                                 .    2 -- Furthest return .LT. 1.5m
    |            . .                  . .  3 -- Slope hazard
-1.0+                                 .    4 -- Step  hazard
    |              .                  .    5 -- Crosspath hazard
    |                  . .          . .    6 -- Bad data
-2.0+            .                 . .
    ------------------------------------> X
    0      1       2       3       4       Points off scale:  0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	NO	HAZARDS	CATALOGED		
2	-40.74	NO	HAZARDS	CATALOGED		
3	-37.93	NO	HAZARDS	CATALOGED		
4	-35.13	NO	HAZARDS	CATALOGED		
5	-32.31	NO	HAZARDS	CATALOGED		
6	-29.50	NO	HAZARDS	CATALOGED		
7	-26.69	NO	HAZARDS	CATALOGED		
8	-23.88	NO	HAZARDS	CATALOGED		
9	-21.08	NO	HAZARDS	CATALOGED		
10	-18.26	NO	HAZARDS	CATALOGED		
11	-15.45	NO	HAZARDS	CATALOGED		
12	-12.64	NO	HAZARDS	CATALOGED		
13	-9.84	NO	HAZARDS	CATALOGED		
14	-7.02	NO	HAZARDS	CATALOGED		
15	-4.22	NO	HAZARDS	CATALOGED		
16	-1.41	NO	HAZARDS	CATALOGED		
17	1.40	NO	HAZARDS	CATALOGED		
19	7.02	NO	HAZARDS	CATALOGED		
20	9.83	NO	HAZARDS	CATALOGED		
21	12.64	NO	HAZARDS	CATALOGED		
22	15.45	1.72	1.66	0.46	-0.01	Step hazard
23	18.26	NO	HAZARDS	CATALOGED		
24	21.07	NO	HAZARDS	CATALOGED		
25	23.88	NO	HAZARDS	CATALOGED		
26	26.69	NO	HAZARDS	CATALOGED		
27	29.50	NO	HAZARDS	CATALOGED		
28	32.31	NO	HAZARDS	CATALOGED		
29	35.12	NO	HAZARDS	CATALOGED		
30	37.93	NO	HAZARDS	CATALOGED		
31	40.74	NO	HAZARDS	CATALOGED		
32	43.55	NO	HAZARDS	CATALOGED		

FIGURE 21. 25 DEGREE SLOPE TEST WITH B=.90

Input file: MDL.SLOPE.30.30.90
File Creation Date : THU, AUG 11 1983   System time   19:29:12

**   MODEL PARAMETERS   **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH (deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O H A Z A R D S C A T A L O G E D			
2	-40.74	N O H A Z A R D S C A T A L O G E D			
3	-37.93	N O H A Z A R D S C A T A L O G E D			
4	-35.13	N O H A Z A R D S C A T A L O G E D			
5	-32.31	N O H A Z A R D S C A T A L O G E D			
6	-29.50	N O H A Z A R D S C A T A L O G E D			
7	-26.69	N O H A Z A R D S C A T A L O G E D			
8	-23.88	N O H A Z A R D S C A T A L O G E D			
9	-21.08	N O H A Z A R D S C A T A L O G E D			
10	-18.26	N O H A Z A R D S C A T A L O G E D			
11	-15.45	N O H A Z A R D S C A T A L O G E D			
12	-12.64	N O H A Z A R D S C A T A L O G E D			
13	-9.84	1.84	1.81	-0.31	0.19	Step hazard
14	-7.02	N O H A Z A R D S C A T A L O G E D			
15	-4.22	N O H A Z A R D S C A T A L O G E D			
16	-1.41	N O H A Z A R D S C A T A L O G E D			
17	1.40	1.55	1.55	0.04	-0.00	Step hazard
18	4.21	1.55	1.55	0.11	-0.00	Step hazard
19	7.02	N O H A Z A R D S C A T A L O G E D			
20	9.83	N O H A Z A R D S C A T A L O G E D			
21	12.64	N O H A Z A R D S C A T A L O G E D			
22	15.45	1.82	1.76	0.49	0.15	Step hazard
23	18.26	1.53	1.47	0.49	-0.01	Step hazard
		1.75	1.66	0.55	-0.01	Crosspath hazard
24	21.07	N O H A Z A R D S C A T A L O G E D			
25	23.88	N O H A Z A R D S C A T A L O G E D			
26	26.69	N O H A Z A R D S C A T A L O G E D			
27	29.50	N O H A Z A R D S C A T A L O G E D			
28	32.31	N O H A Z A R D S C A T A L O G E D			
29	35.12	N O H A Z A R D S C A T A L O G E D			
30	37.93	N O H A Z A R D S C A T A L O G E D			
31	40.74	N O H A Z A R D S C A T A L O G E D			
32	43.55	N O H A Z A R D S C A T A L O G E D			

FIGURE 22. 30 DEGREE SLOPE TEST WITH B=.90

Input file: MDL.SLOPE.35.30.90
File Creation Date : THU, AUG 11 1983   System time   19:31:35

              ** MODEL1 PARAMETERS **
        HEIGHT FILTER COEFFICIENT =   0.25
        SLOPE FILTER COEFFICIENT =   0.90
        LEVEL GROUND STEP THRESHOLD =   0.25 METERS
        SLOPE THRESHOLD =   30.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	1.82	1.79	-0.31	0.27	Step hazard
14	-7.02	1.51	1.50	-0.19	0.07	Step hazard
15	-4.22	N O	H A Z A R D S	C A T A L O G E D		
16	-1.41	1.51	1.51	-0.04	0.06	Step hazard
17	1.40	1.51	1.51	0.04	0.07	Step hazard
18	4.21	1.63	1.62	0.12	0.23	Step hazard
19	7.02	N O	H A Z A R D S	C A T A L O G E D		
20	9.83	1.51	1.49	0.26	0.07	Step hazard
21	12.64	N O	H A Z A R D S	C A T A L O G E D		
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	1.61	1.53	0.50	0.07	Step hazard
		1.75	1.66	0.55	0.07	Crosspath hazard
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

FIGURE 23. 35 DEGREE SLOPE TEST WITH B=.90

Input file: RDL.SLOPE.20.30.85
File Creation Date : THU, AUG 11 1983   System time   19:41:05

```
        **  MODEL1 PARAMETERS  **
    HEIGHT FILTER COEFFICIENT :          0.25
    SLOPE FILTER COEFFICIENT  :          0.85
    LEVEL GROUND STEP THRESHOLD :        0.25 METERS
    SLOPE THRESHOLD :                    30.00 DEGREES
```



```
AZIMUTH  (deg)   RANGE      X       Y        Z     HAZARD TYPE
  1      -43.56   N O   H A Z A R D S   C A T A L O G E D
  2      -40.74   N O   H A Z A R D S   C A T A L O G E D
  3      -37.93   N O   H A Z A R D S   C A T A L O G E D
  4      -35.13   N O   H A Z A R D S   C A T A L O G E D
  5      -32.31   N O   H A Z A R D S   C A T A L O G E D
  6      -29.50   N O   H A Z A R D S   C A T A L O G E D
  7      -26.69   N O   H A Z A R D S   C A T A L O G E D
  8      -23.88   N O   H A Z A R D S   C A T A L O G E D
  9      -21.08   N O   H A Z A R D S   C A T A L O G E D
 10      -18.26   N O   H A Z A R D S   C A T A L O G E D
 11      -15.45   N O   H A Z A R D S   C A T A L O G E D
 12      -12.64   N O   H A Z A R D S   C A T A L O G E D
 13       -9.84   N O   H A Z A R D S   C A T A L O G E D
 14       -7.02   N O   H A Z A R D S   C A T A L O G E D
 15       -4.22   N O   H A Z A R D S   C A T A L O G E D
 16       -1.41   N O   H A Z A R D S   C A T A L O G E D
 17        1.40   N O   H A Z A R D S   C A T A L O G E D
 18        4.21   N O   H A Z A R D S   C A T A L O G E D
 19        7.02   N O   H A Z A R D S   C A T A L O G E D
 20        9.83   N O   H A Z A R D S   C A T A L O G E D
 21       12.64   2.04    1.99    0.45   -0.01   Step hazard
                  2.25    2.20    0.49   -0.01   Crosspath hazard
 22       15.45   N O   H A Z A R D S   C A T A L O G E D
 23       18.26   N O   H A Z A R D S   C A T A L O G E D
 24       21.07   N O   H A Z A R D S   C A T A L O G E D
 25       23.88   N O   H A Z A R D S   C A T A L O G E D
 26       26.69   N O   H A Z A R D S   C A T A L O G E D
 27       29.50   N O   H A Z A R D S   C A T A L O G E D
 28       32.31   N O   H A Z A R D S   C A T A L O G E D
 29       35.12   N O   H A Z A R D S   C A T A L O G E D
 30       37.93   N O   H A Z A R D S   C A T A L O G E D
 31       40.74   N O   H A Z A R D S   C A T A L O G E D
 32       43.55   N O   H A Z A R D S   C A T A L O G E D
```

FIGURE 24. 20 DEGREE SLOPE TEST WITH B=.85

Input file: MDL.SLOPE.25.30.85
File Creation Date : THU, AUG 11 1983   System time   19:41:44

** MODEL1 PARAMETERS **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.85
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	N O	H A Z A R D S	C A T A L O G E D		
16	-1.41	N O	H A Z A R D S	C A T A L O G E D		
17	1.40	1.84	1.84	0.05	0.12	Step hazard
19	7.02	N O	H A Z A R D S	C A T A L O G E D		
20	9.83	N O	H A Z A R D S	C A T A L O G E D		
21	12.64	N O	H A Z A R D S	C A T A L O G E D		
22	15.45	1.72	1.66	0.46	-0.01	Step hazard
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

FIGURE 25. 25 DEGREE SLOPE TEST WITH B=.85

Input file: MDL.SLOPE.30.30.85
File Creation Date : THU, AUG 11 1983   System time   19:42:39

**   MODEL: PARAMETERS **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.85
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

```
2.0 +                          ..
    |                          ..
    |
    |
1.0 +                        ..
    |                             ..            X vs. Y for
    |         ..     5 .        ..             hazards of
    |               44 4 .       ..             scan #  1
    |                4
0.0 +                44        .      .        Number key:
    |                4          .              1 -- Insufficient data
    |                 .          .             2 -- Furthest return .LT. 1.5m
    |                   4         .            3 -- Slope hazard
    |              .              ..            4 -- Step hazard
-1.0 +                .          ..              5 -- Crosspath hazard
    |              ..                           6 -- Bad data
    |                    ..
    |              ..
-2.0 +                   ..
    ----------------------------------------> X
    0        .1        2         3        4        Points off scale:  0
             .
```

AZIMUT	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S		C A T A L O G E D	
2	-40.74	N O	H A Z A R D S		C A T A L O G E D	
3	-37.93	N O	H A Z A R D S		C A T A L O G E D	
4	-35.13	N O	H A Z A R D S		C A T A L O G E D	
5	-32.31	N O	H A Z A R D S		C A T A L O G E D	
6	-29.50	N O	H A Z A R D S		C A T A L O G E D	
7	-26.69	N O	H A Z A R D S		C A T A L O G E D	
8	-23.88	N O	H A Z A R D S		C A T A L O G E D	
9	-21.08	N O	H A Z A R D S		C A T A L O G E D	
10	-18.26	N O	H A Z A R D S		C A T A L O G E D	
11	-15.45	N O	H A Z A R D S		C A T A L O G E D	
12	-12.64	N O	H A Z A R D S		C A T A L O G E D	
13	-9.84	1.84	1.81	-0.31	0.19	Step hazard
14	-7.02	1.61	1.60	-0.20	0.04	Step hazard
15	-4.22	N O	H A Z A R D S		C A T A L O G E D	
16	-1.41	1.61	1.61	-0.04	0.04	Step hazard
17	1.40	1.61	1.61	0.04	0.03	Step hazard
		1.73	1.73	0.04	0.18	Step hazard
18	4.21	1.61	1.61	0.12	0.05	Step hazard
19	7.02	N O	H A Z A R D S		C A T A L O G E D	
20	9.83	N O	H A Z A R D S		C A T A L O G E D	
21	12.64	N O	H A Z A R D S		C A T A L O G E D	
22	15.45	1.61	1.53	0.43	0.04	Step hazard
		1.82	1.76	0.49	0.15	Step hazard
23	18.26	1.55	1.47	0.49	-0.01	Step hazard
		1.75	1.66	0.55	-0.01	Crosspath hazard
24	21.07	N O	H A Z A R D S		C A T A L O G E D	
25	23.88	N O	H A Z A R D S		C A T A L O G E D	
26	26.69	N O	H A Z A R D S		C A T A L O G E D	
27	29.50	N O	H A Z A R D S		C A T A L O G E D	
28	32.31	N O	H A Z A R D S		C A T A L O G E D	
29	35.12	N O	H A Z A R D S		C A T A L O G E D	
30	37.93	N O	H A Z A R D S		C A T A L O G E D	
31	40.74	N O	H A Z A R D S		C A T A L O G E D	
32	43.55	N O	H A Z A R D S		C A T A L O G E D	

FIGURE 26. 30 DEGREE SLOPE TEST WITH B=.85

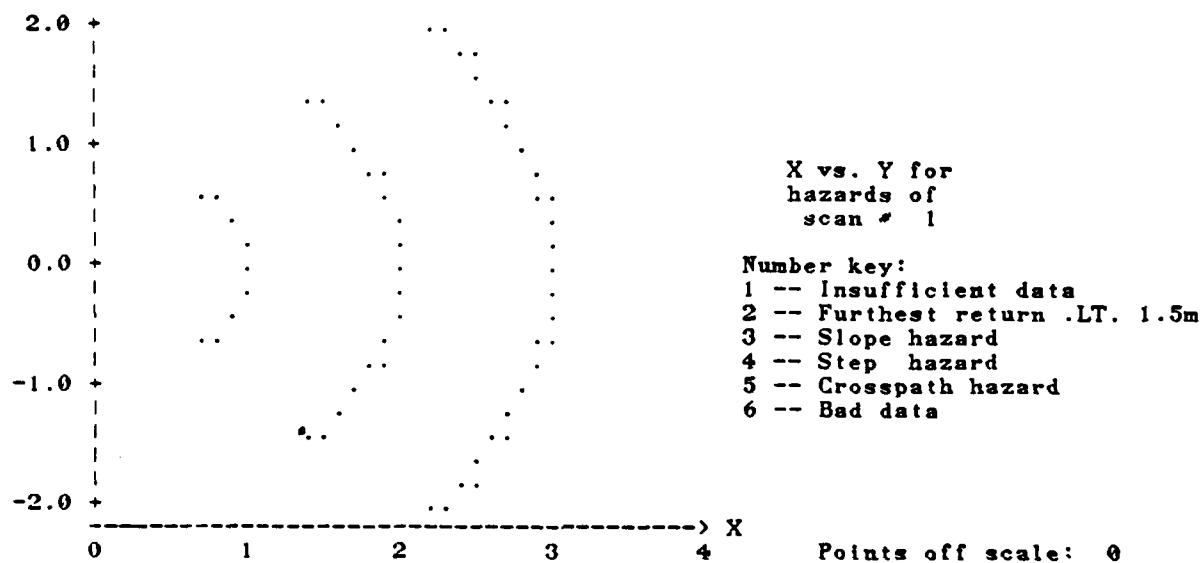Input file: MDL.SLOPE.35.30.85
File Creation Date : THU, AUG 11 1983   System time   19:43:15

```
        **  MODEL1 PARAMETERS  **
    HEIGHT FILTER COEFFICIENT =        0.25
    SLOPE FILTER COEFFICIENT  =        0.85
    LEVEL GROUND STEP THRESHOLD =      0.25 METERS
    SLOPE THRESHOLD =                  30.00 DEGREES
```
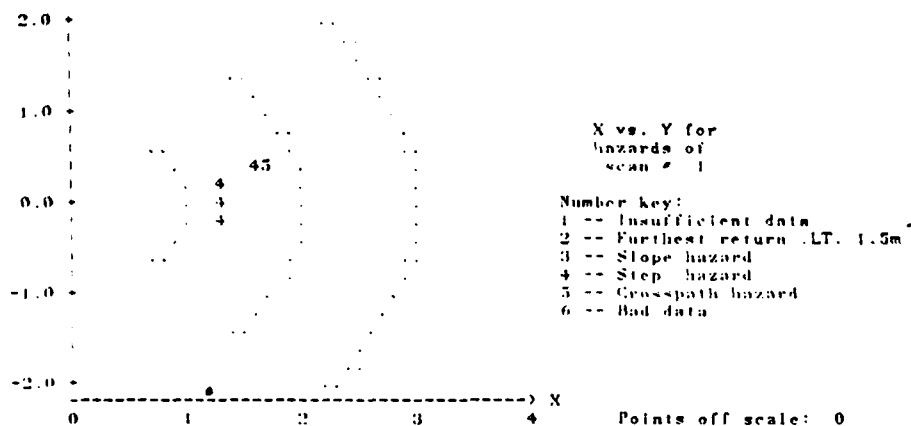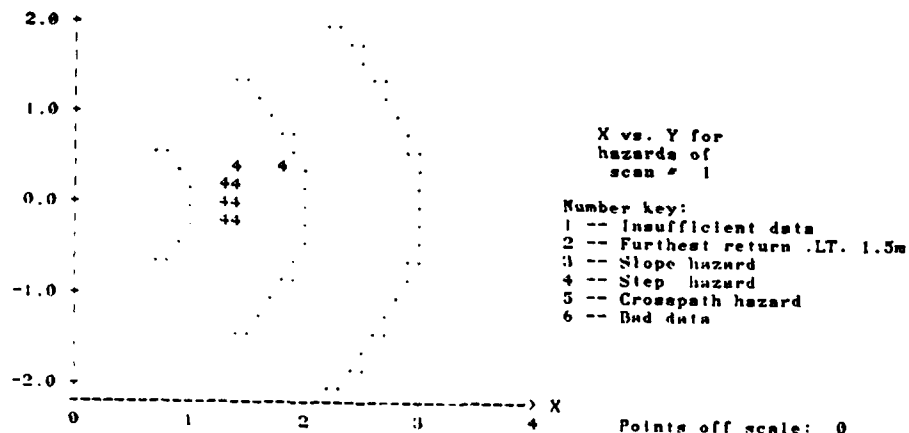
```
 2.0 +                    ..
     |                 .        ..
     |            ..                .
     |
 1.0 +          ..                    .
     |                    4 5        ..          X vs. Y for
     |       ..                        ..        hazards of
     |                    433 .                   scan # 1
 0.0 +      .      4 44    .             .        Number key:
     |           44 4                  .         1 -- Insufficient data
     |           .           4    .              2 -- Furthest return .LT. 1.5m
     |                  ..                        3 -- Slope hazard
-1.0 +          .                      .          4 -- Step hazard
     |                                            5 -- Crosspath hazard
     |          ..                                6 -- Bad data
     |
-2.0 +                   ..
     ---------------------------------> X
     0        1        2        3        4        Points off scale:  0
```

AZ	IMUTH (deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	1.30	1.28	-0.22	-0.05	Step hazard
		1.51	1.49	-0.26	0.07	Step hazard
		1.82	1.79	-0.31	0.27	Step hazard
14	-7.02	1.26	1.25	-0.15	-0.14	Step hazard
		1.51	1.50	-0.19	0.07	Step hazard
15	-4.22	1.51	1.51	-0.11	0.04	Step hazard
		1.51	1.51	-0.11	0.04	Step hazard
16	-1.41	1.30	1.30	-0.03	-0.05	Step hazard
		1.51	1.51	-0.04	0.06	Step hazard
17	1.40	1.51	1.51	0.04	0.07	Step hazard
		1.63	1.62	0.04	0.23	Step hazard
18	4.21	1.56	1.56	0.11	0.18	Slope hazard
		1.63	1.62	0.12	0.23	Slope hazard
		1.72	1.72	0.13	0.30	Slope hazard
19	7.02	1.51	1.50	0.19	0.06	Step hazard
20	9.83	1.51	1.49	0.26	0.07	Step hazard
21	12.64	N O	H A Z A R D S	C A T A L O G E D		
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	1.61	1.53	0.50	0.07	Step hazard
		1.75	1.66	0.55	0.07	Crosspath hazard
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

FIGURE 27. 35 DEGREE SLOPE TEST WITH B=.85

When the height of the varying height obstacle was between 15 to 20 cm, there should be only step hazards detected on the non-contacting edge of the fixed obstacle. This is because the height difference between the two obstacles does not constitute a hazard. As soon as the height of the varying obstacle was 20 cm (8 in) or greater than the fixed obstacle, there should be step hazards detected on all sides of the large hazard. Some results are given in Figures 28, 29, and 30. Complete results are given in Appendix Section 7.2.3. As expected, with relatively large differences between the fixed and the unfixed hazard, there was a crosspath hazard catalogued by the modeler. When this difference became less than 20 cm (8 in), the crosspath hazard disappeared. As the varying hazard reached a height of 25 cm (10 in), a step hazard was generated. These were exactly the results that were desired.

4.4 Parallel Obstacles Tests

Another test, which uncovered a modeler deficiency, was a test of the modeler's ability to detect the existance of a hazard when the vehicle cannot pass between 2 step hazards. Two obstacles 31 cm (12 in) wide and 185 cm (72 in) long were placed parallel to each other about 1 meter from the mast. The distance between them was varied from 150 to 100 cm in 10 cm steps (59 to 39 in in 4 in steps). This type of hazard would be encountered if the terrain included a narrow pass that had to be traversed.

Input file: MDL.TWO.14.00
File Creation Date : SAT. AUG 06 1983   System time   17:48:31

== MODEL1 PARAMETERS ==
HEIGHT FILTER COEFFICIENT :   0.25
SLOPE FILTER COEFFICIENT :   0.90
LEVEL GROUND STEP THRESHOLD :   0.25 METERS
SLOPE THRESHOLD :   30.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH (deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.36	N O	H A Z A R D S	C A T A L O G E D	
2	-40.74	N O	H A Z A R D S	C A T A L O G E D	
3	-37.93	N O	H A Z A R D S	C A T A L O G E D	
4	-33.13	N O	H A Z A R D S	C A T A L O G E D	
5	-32.31	N O	H A Z A R D S	C A T A L O G E D	
6	-29.30	N O	H A Z A R D S	C A T A L O G E D	
7	-26.49	1.37	1.19	-0.67	-0.37	Step hazard
		1.35	1.18	-0.69	-0.37	Step hazard
		1.55	1.39	-0.70	-0.03	Step hazard
8	-23.88	1.33	1.21	-0.54	-0.38	Step hazard
		1.33	1.21	-0.54	-0.38	Step hazard
		1.37	1.25	-0.53	-0.36	Step hazard
		1.41	1.29	-0.57	-0.34	Step hazard
9	-21.08	1.33	1.24	-0.48	-0.30	Step hazard
		1.33	1.24	-0.48	-0.38	Step hazard
10	-18.26	1.33	1.26	-0.42	-0.38	Step hazard
		1.33	1.26	-0.42	-0.38	Step hazard
		1.33	1.26	-0.42	-0.38	Step hazard
		1.37	1.30	-0.43	-0.36	Step hazard
11	-15.43	1.29	1.24	-0.34	-0.37	Step hazard
		1.29	1.24	-0.34	-0.37	Step hazard
		1.29	1.24	-0.34	-0.37	Step hazard
		1.33	1.28	-0.35	-0.37	Step hazard
		1.96	1.89	-0.52	0.01	Step hazard
12	-12.64	1.29	1.26	-0.28	-0.37	Step hazard
		1.29	1.26	-0.28	-0.37	Step hazard
		1.29	1.26	-0.28	-0.37	Step hazard
		1.32	1.29	-0.29	-0.36	Step hazard
13	-9.84	1.32	1.30	-0.23	-0.36	Step hazard
		1.32	1.30	-0.23	-0.36	Step hazard
		1.37	1.35	-0.23	-0.36	Step hazard
14	-7.02	1.29	1.28	-0.16	-0.37	Step hazard
		1.29	1.28	-0.16	-0.37	Step hazard
		1.29	1.28	-0.16	-0.37	Step hazard
		1.32	1.31	-0.16	-0.36	Step hazard
		1.96	1.94	-0.24	0.00	Step hazard
15	-4.22	1.29	1.29	-0.09	-0.37	Step hazard
		1.29	1.29	-0.09	-0.37	Step hazard
		1.29	1.29	-0.09	-0.37	Step hazard
16	-1.41	1.29	1.29	-0.03	-0.37	Step hazard
		1.29	1.29	-0.03	-0.37	Step hazard
		1.29	1.29	-0.03	-0.37	Step hazard
		1.32	1.32	-0.03	-0.37	Step hazard
		1.30	1.30	-0.04	-0.36	Step hazard
		1.75	1.75	-0.04	0.03	Crosspath hazard
		1.80	1.80	-0.05	0.01	Crosspath hazard
		2.00	2.00	-0.05	0.01	Step hazard
		2.00	2.00	-0.05	0.01	Crosspath hazard
17	1.40	N O	H A Z A R D S	C A T A L O G E D	
18	4.21	N O	H A Z A R D S	C A T A L O G E D	
19	7.02	N O	H A Z A R D S	C A T A L O G E D	
20	9.83	N O	H A Z A R D S	C A T A L O G E D	
21	12.64	N O	H A Z A R D S	C A T A L O G E D	
22	15.43	N O	H A Z A R D S	C A T A L O G E D	
23	18.26	N O	H A Z A R D S	C A T A L O G E D	
24	21.07	N O	H A Z A R D S	C A T A L O G E D	
25	23.88	N O	H A Z A R D S	C A T A L O G E D	
26	26.69	N O	H A Z A R D S	C A T A L O G E D	
27	29.50	N O	H A Z A R D S	C A T A L O G E D	
28	32.31	N O	H A Z A R D S	C A T A L O G E D	
29	33.12	N O	H A Z A R D S	C A T A L O G E D	
30	37.93	N O	H A Z A R D S	C A T A L O G E D	
31	40.74	N O	H A Z A R D S	C A T A L O G E D	
32	43.55	N O	H A Z A R D S	C A T A L O G E D	

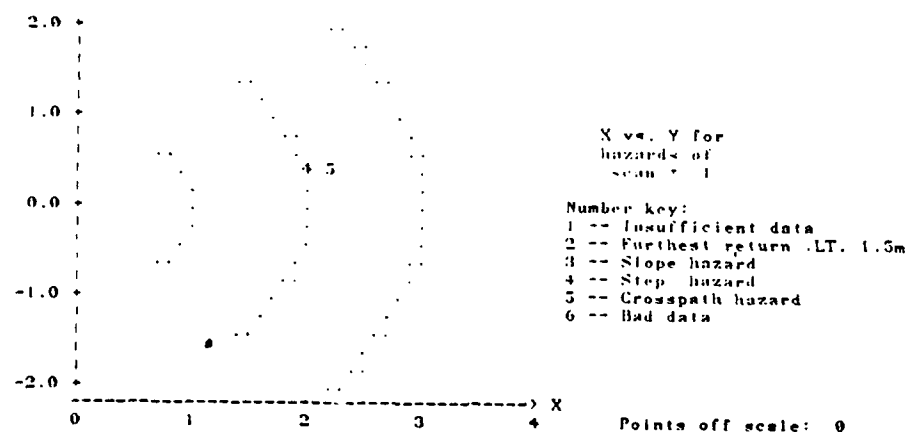FIGURE 28. TWO OBSTACLES TEST: HEIGHTS AT 0 AND 35 CM
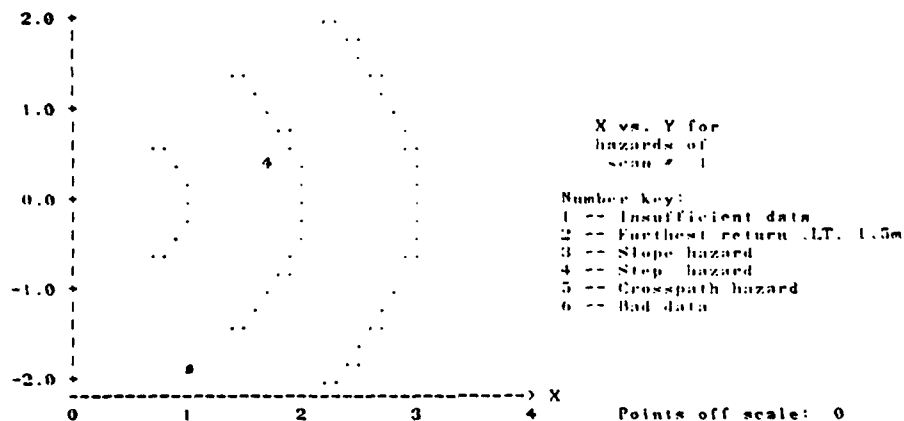
56

Input file: HDL.TWO.14.88
File Creation Date : SAT. AUG 06 1983   System time   23:57:20

** MODEL PARAMETERS **
HEIGHT FILTER COEFFICIENT :   0.25
SLOPE FILTER COEFFICIENT :   0.90
LEVEL GROUND STEP THRESHOLD :   0.25 METERS
SLOPE THRESHOLD :   30.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Farthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH (deg)	RANGE	X	Y	Z	HAZARD TYPE
1 -43.36	NO HAZARDS CATALOGED				
2 -40.74	NO HAZARDS CATALOGED				
3 -37.93	NO HAZARDS CATALOGED				
4 -35.13	NO HAZARDS CATALOGED				
5 -32.31	NO HAZARDS CATALOGED				
6 -29.50	1.33	1.15	-0.63	-0.37	Step hazard
7 -26.69	1.33	1.18	-0.60	-0.38	Step hazard
	1.33	1.18	-0.60	-0.38	Step hazard
	1.41	1.26	-0.63	-0.36	Step hazard
	1.41	1.26	-0.63	-0.36	Step hazard
	1.72	1.53	-0.77	0.01	Step hazard
8 -23.88	1.33	1.21	-0.56	-0.38	Step hazard
	1.33	1.21	-0.56	-0.38	Step hazard
	1.33	1.21	-0.56	-0.38	Step hazard
	1.41	1.29	-0.57	-0.36	Step hazard
	1.41	1.29	-0.57	-0.36	Step hazard
9 -21.88	1.29	1.20	-0.46	-0.37	Step hazard
	1.29	1.20	-0.46	-0.37	Step hazard
	1.33	1.24	-0.48	-0.37	Step hazard
	1.37	1.27	-0.49	-0.29	Step hazard
10 -18.24	1.29	1.22	-0.40	-0.37	Step hazard
	1.29	1.22	-0.40	-0.37	Step hazard
	1.33	1.26	-0.42	-0.37	Step hazard
11 -15.43	1.33	1.28	-0.35	-0.38	Step hazard
	1.33	1.28	-0.35	-0.38	Step hazard
	1.33	1.28	-0.35	-0.38	Step hazard
12 -12.64	1.33	1.29	-0.29	-0.38	Step hazard
	1.33	1.29	-0.29	-0.38	Step hazard
	1.33	1.29	-0.29	-0.38	Step hazard
	1.33	1.29	-0.29	-0.38	Step hazard
13 -9.84	1.29	1.27	-0.22	-0.37	Step hazard
	1.29	1.27	-0.22	-0.37	Step hazard
	1.29	1.27	-0.22	-0.37	Step hazard
	1.72	1.30	-0.25	-0.36	Step hazard
	1.88	1.43	-0.32	0.03	Step hazard
14 -7.03	1.29	1.28	-0.16	-0.37	Step hazard
	1.29	1.28	-0.16	-0.37	Step hazard
	1.29	1.28	-0.16	-0.37	Step hazard
15 -4.23	1.33	1.32	-0.10	-0.38	Step hazard
	1.33	1.32	-0.10	-0.38	Step hazard
	1.33	1.32	-0.10	-0.38	Step hazard
	1.33	1.32	-0.10	-0.38	Step hazard
	1.88	1.87	-0.14	0.00	Step hazard
16 -1.41	NO HAZARDS CATALOGED				
17 1.40	NO HAZARDS CATALOGED				
18 4.21	NO HAZARDS CATALOGED				
19 7.02	NO HAZARDS CATALOGED				
20 9.83	NO HAZARDS CATALOGED				
21 12.64	NO HAZARDS CATALOGED				
22 15.43	NO HAZARDS CATALOGED				
23 18.24	NO HAZARDS CATALOGED				
24 21.07	NO HAZARDS CATALOGED				
25 23.88	NO HAZARDS CATALOGED				
26 26.69	NO HAZARDS CATALOGED				
27 29.50	NO HAZARDS CATALOGED				
28 32.31	NO HAZARDS CATALOGED				
29 35.12	NO HAZARDS CATALOGED				
30 37.93	NO HAZARDS CATALOGED				
31 40.74	NO HAZARDS CATALOGED				
32 43.55	NO HAZARDS CATALOGED				

FIGURE 29. TWO OBSTACLES TEST: HEIGHTS AT 20 AND 35 CM

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FIGURE 30. TWO OBSTACLES TEST: HEIGHTS AT 35 AND 35 CM

Some of the results are shown in Figure 31 with others found in Appendix Section 7.2.4. Given that the vehicle is 135 cm wide at its widest point, any path created whose width were less than this would have to be declared unsafe. This is something that the modeler does not test for, therefore, a path selection algorithm would have to determine that this situation were a hazard. A path selection algorithm was not used during any of these tests.

4.5 Insufficient Data Returned Tests

To show the modeler's ability to recognize the condition when less than one-fourth of the total number of returns for a particular azimuth are received, a large obstacle was placed in front of the mast which would effectively block most of the returns for several of the azimuths. Similarly, an obstacle was set up to prevent returns from distances greater than 1.5 meters, from the mast, from reaching the detectors. The results of these tests are shown graphically in Figures 32 and 33, and respectively.

4.6 Range Tests

To help determine how well the vision system can determine the range of hazards, ranging tests were performed. A single obstacle 30 by 30 cm was placed at in front of the mast at distances ranging from 40 to 230 cm (16 to 90 in) in 10 cm (4 in) increments. The
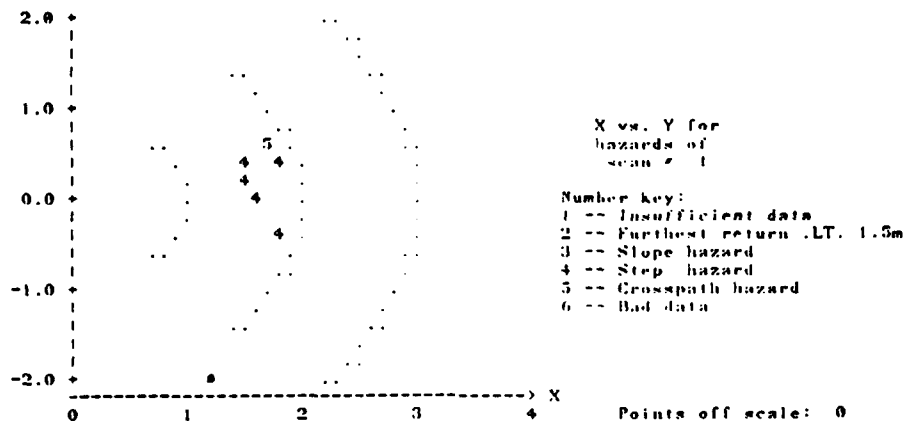
Input file: MDL.PATH.10
File Creation Date : WED, AUG 10 1983   System time   19:27:37

** MODEL1 PARAMETERS **
HEIGHT FILTER COEFFICIENT =   0.23
SLOPE FILTER COEFFICIENT =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
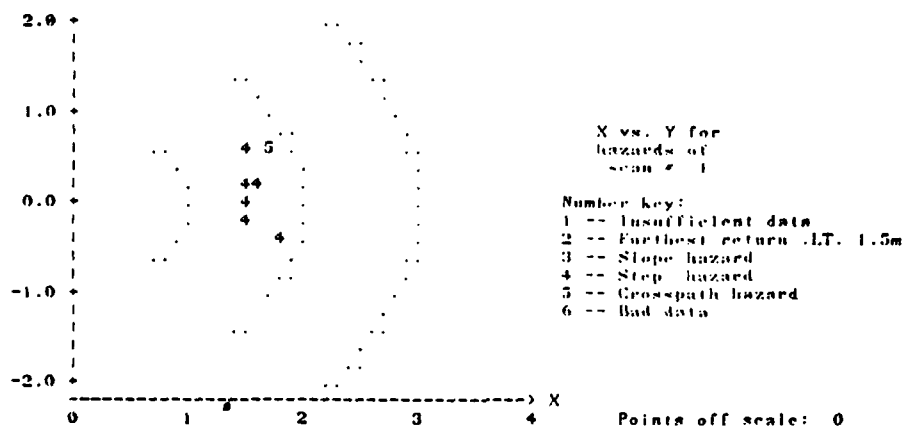SLOPE THRESHOLD =   30.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O				HAZARDS CATALOGED
2	-40.74	N O				HAZARDS CATALOGED
3	-37.93	N O				HAZARDS CATALOGED
4	-35.13	1.37	1.12	-0.79	-0.36	Step hazard
5	-32.31	1.29	1.09	-0.69	-0.37	Step hazard
		1.41	1.19	-0.75	-0.34	Step hazard
		1.41	1.19	-0.75	-0.34	Step hazard
		1.65	1.40	-0.08	0.01	Step hazard
6	-29.50	1.33	1.13	-0.63	-0.38	Step hazard
		1.33	1.13	-0.63	-0.38	Step hazard
		1.33	1.13	-0.63	-0.33	Step hazard
		1.15	1.15	-0.63	-0.38	Step hazard
7	-26.69	1.17	1.16	-0.60	-0.38	Step hazard
		1.17	1.16	-0.60	-0.38	Step hazard
		1.33	1.13	-0.60	-0.38	Step hazard
8	-23.70	1.29	1.18	-0.72	-0.37	Step hazard
		1.29	1.18	-0.72	-0.37	Step hazard
		1.73	1.30	-0.54	-0.37	Step hazard
		1.17	1.23	-0.33	-0.36	Step hazard
		1.50	1.37	-0.41	0.04	Crosspath hazard
9	-21.00	1.55	1.44	-0.56	-0.23	Step hazard
		1.72	1.50	-0.62	-0.00	Step hazard
		1.73	1.63	-0.63	-0.00	Crosspath hazard
10	-18.26	1.84	1.74	-0.50	-0.13	Step hazard
		2.00	1.90	-0.63	-0.00	Crosspath hazard
11	-15.43	2.09	2.03	-0.56	-0.37	Step hazard
		2.50	2.41	-0.67	-0.07	Crosspath hazard
		2.73	2.63	-0.73	-0.05	Crosspath hazard
12	-12.64	N O				HAZARDS CATALOGED
13	-9.84	N O				HAZARDS CATALOGED
14	-7.02	N O				HAZARDS CATALOGED
15	-4.22	N O				HAZARDS CATALOGED
16	-1.41	N O				HAZARDS CATALOGED
17	1.40	N O				HAZARDS CATALOGED
18	4.21	N O				HAZARDS CATALOGED
19	7.02	N O				HAZARDS CATALOGED
20	9.83	N O				HAZARDS CATALOGED
21	12.64	N O				HAZARDS CATALOGED
22	15.43	2.09	2.03	0.56	-0.37	Step hazard
		2.16	2.08	0.57	-0.18	Step hazard
		2.29	2.21	0.61	-0.29	Step hazard
23	18.26	1.97	1.87	0.62	-0.20	Step hazard
		2.04	1.93	0.64	-0.06	Step hazard
24	21.07	1.61	1.51	0.58	-0.38	Step hazard
		1.71	1.60	0.61	-0.31	Step hazard
25	23.88	1.51	1.38	0.61	-0.25	Step hazard
26	26.49	1.33	1.18	0.60	-0.37	Step hazard
		1.41	1.26	0.63	-0.34	Step hazard
27	29.30	1.41	1.26	0.63	-0.34	Step hazard
		1.33	1.13	0.63	-0.38	Step hazard
		1.41	1.22	0.69	-0.34	Step hazard
		1.41	1.22	0.69	-0.34	Step hazard
28	32.31	1.96	1.70	0.94	-0.00	Step hazard
		1.33	1.12	0.71	-0.37	Step hazard
		1.41	1.19	0.75	-0.34	Step hazard
29	35.12	1.41	1.19	0.75	-0.34	Step hazard
		1.17	1.12	0.79	-0.36	Step hazard
		1.41	1.15	0.81	-0.34	Step hazard
30	37.93	1.42	1.12	0.91	0.02	Step hazard
		1.17	1.08	0.84	-0.37	Step hazard
		1.71	1.30	1.03	-0.03	Crosspath hazard
31	40.74	N O				HAZARDS CATALOGED
32	43.55	N O				HAZARDS CATALOGED

FIGURE 31. PATH OBSTACLE TEST WITH 1 METER SEPARATION

Input file: MDL.08/12/83.#00
File Creation Date : FRI, AUG 12 1983   System time   22:29:46

```
                    **  MODEL1 PARAMETERS  **
          HEIGHT FILTER COEFFICIENT =          0.25
          SLOPE FILTER COEFFICIENT  =          0.90
          LEVEL GROUND STEP THRESHOLD =        0.25 METERS
          SLOPE THRESHOLD =                   30.00 DEGREES
```
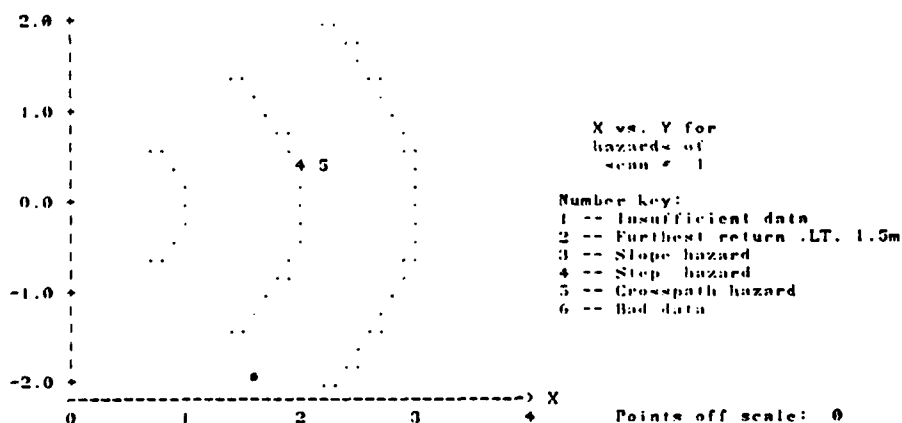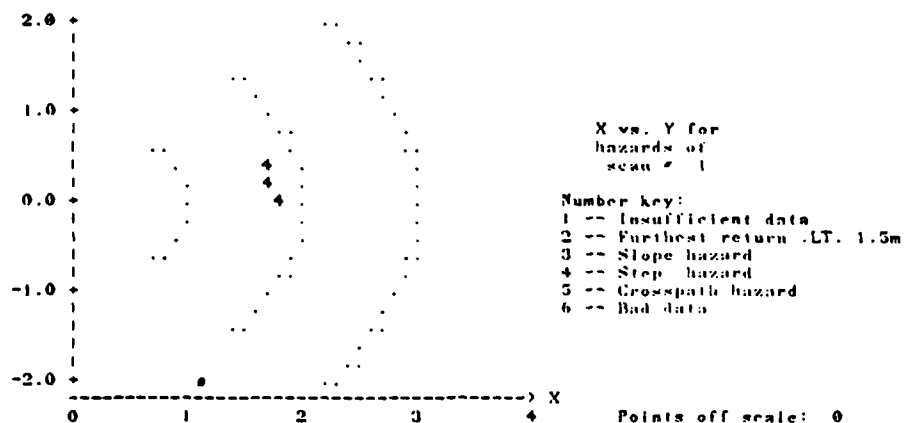

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	1.00	0.72	-0.69	0.00	Insufficient data
2	-40.74	1.00	0.76	-0.65	0.00	Insufficient data
		1.25	0.95	-0.82	0.60	Crosspath hazard
3	-37.93	1.00	0.79	-0.61	0.00	Insufficient data
4	-35.13	1.00	0.82	-0.58	0.00	Insufficient data
5	-32.31	1.00	0.85	-0.53	0.00	Insufficient data
6	-29.50	1.00	0.87	-0.49	0.00	Insufficient data
7	-26.69	1.00	0.89	-0.45	0.00	Insufficient data
8	-23.88	1.00	0.91	-0.40	0.00	Insufficient data
9	-21.08	1.00	0.93	-0.36	0.00	Insufficient data
10	-18.26	1.00	0.95	-0.31	0.00	Insufficient data
11	-15.45	1.00	0.96	-0.27	0.00	Insufficient data
12	-12.64	1.00	0.98	-0.22	0.00	Insufficient data
13	-9.84	1.00	0.99	-0.17	0.00	Insufficient data
14	-7.02	1.00	0.99	-0.12	0.00	Insufficient data
15	-4.22	1.00	1.00	-0.07	0.00	Insufficient data
16	-1.41	N O	H A Z A R D S	C A T A L O G E D		
17	1.40	N O	H A Z A R D S	C A T A L O G E D		
18	4.21	N O	H A Z A R D S	C A T A L O G E D		
19	7.02	N O	H A Z A R D S	C A T A L O G E D		
20	9.83	N O	H A Z A R D S	C A T A L O G E D		
21	12.64	N O	H A Z A R D S	C A T A L O G E D		
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

FIGURE 32. INSUFFICIENT DATA TEST

Input file: MDL.08/12/83.#00
File Creation Date : FRI, AUG 12 1983   System time 22:05:44

                    ** MODEL1 PARAMETERS **
        HEIGHT FILTER COEFFICIENT =   0.25
        SLOPE FILTER COEFFICIENT =   0.90
        LEVEL GROUND STEP THRESHOLD =   0.25 METERS
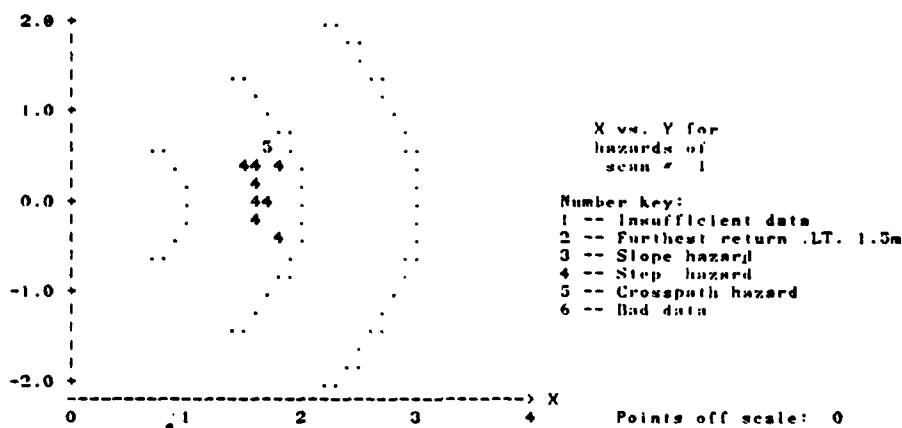   SLOPE THRESHOLD =   30.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	N O	H A Z A R D S	C A T A L O G E D		
16	-1.41	1.43	1.43	-0.04	-0.20	Furthest return .LT. 1.5m
17	1.40	1.43	1.43	0.04	-0.20	Furthest return .LT. 1.5m
18	4.21	1.43	1.43	0.11	-0.20	Furthest return .LT. 1.5m
19	7.02	N O	H A Z A R D S	C A T A L O G E D		
20	9.83	N O	H A Z A R D S	C A T A L O G E D		
21	12.64	N O	H A Z A R D S	C A T A L O G E D		
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

FIGURE 33. NO DATA BEYOND 1.5 METERS TEST

results for 3 of these distances appear in Figures 34, 35, and 36 with complete results in Appendix Section 7.2.5.

The results for the obstacle when very close to the mast included only the falling edges in each case. As can be seen, the calculated range of all of these falling edges was about 25 cm (10 in) further from the mast than their actual occurances. This can probably be attributed to a couple of factors. First, the filtering of the data would tend to slow down the variations and the fact that the calculations are made in increasing range would lend support to this arguement. The other factor is the orientation of the detectors with respect to the hazard. They cannot "see" directly behind the obstacle and only when they receive returns can a definite hazard determination be made.

As the obstacle was placed further and further away, the rising edge was detected. Like the falling edge, it was also detected to be about 25 cm further than it was. This fact lends support to the idea that the filtering has an effect in the determination of a hazard. The fact that the detected positions were always approximately the same distance from being correct suggests that it should be possible to correct for this effeect in software. This, unfortunately, was not attempted.

Finally, once the obstacle was at 230 cm (90 in) or greater, it was no longer detected as a hazard. This implies that the useful

Input file: MDL.RANGE.04
File Creation Date : WED, AUG 10 1983   System time   20:56:29

** MODEL1 PARAMETERS **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT   =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

X vs. Y for
hazards of
 scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

NO HAZARDS CATALOGED THIS SCAN

FIGURE 34. 40 CM RANGE TEST

Input file: MDL.RANGE.07
File Creation Date : WED, AUG 10 1983   System time   20:47:50

```
                 **   MODEL1 PARAMETERS   **
          HEIGHT FILTER COEFFICIENT =        0.25
          SLOPE FILTER COEFFICIENT  =        0.90
          LEVEL GROUND STEP THRESHOLD =      0.25 METERS
          SLOPE THRESHOLD =                 30.00 DEGREES
```
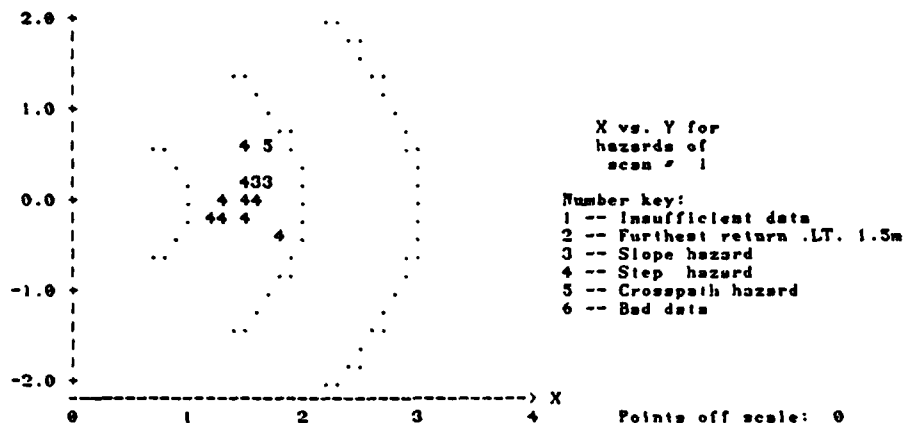
```
2.0 +                         ..
    |                                 ..
    |                      ..
    |                                 ..
1.0 +
    |                      ..              .
    |         ..                 ..            X vs. Y for
    |     .4                                   hazards of
    |         4                                scan # 1
0.0 +         . 4
    |                      .       .           Number key:
    |                                          1 -- Insufficient data
    |                                          2 -- Furthest return .LT. 1.5m
    |         ..                 .             3 -- Slope hazard
-1.0 +                 ..                      4 -- Step hazard
    |                            .             5 -- Crosspath hazard
    |                      ..                  6 -- Bad data
    |                          ..
-2.0 +                    ..
    ---------------------------------> X
    0         1         2         3         4     Points off scale:  0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	N O	H A Z A R D S	C A T A L O G E D		
16	-1.41	N O	H A Z A R D S	C A T A L O G E D		
17	1.40	N O	H A Z A R D S	C A T A L O G E D		
18	4.21	1.22	1.22	0.09	0.02	Step hazard
19	7.02	N O	H A Z A R D S	C A T A L O G E D		
20	9.83	1.26	1.24	0.21	0.02	Step hazard
21	12.64	1.26	1.23	0.28	0.02	Step hazard
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	1.06	1.00	0.33	0.01	Step hazard
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

FIGURE 35. 70 CM RANGE TEST

Input file: MDL.RANGE.23
File Creation Date : WED, AUG 10 1983   System time   20:26:51

```
              **  MODEL1 PARAMETERS  **
       HEIGHT FILTER COEFFICIENT =          0.25
       SLOPE FILTER COEFFICIENT  =          0.90
       LEVEL GROUND STEP THRESHOLD =        0.25 METERS
       SLOPE THRESHOLD =                    30.00 DEGREES
```



```
2.0 +                          . .
    |                             .
    |                   . .        .
    |                     .          . .
1.0 +                  .               .
    |                                         X vs. Y for
    |                    . .          .       hazards of
    |          . .                    . .        scan #  1
0.0 +                     .            .
    |       .                          .      Number key:
    |                                         1 -- Insufficient data
    |                     .           .       2 -- Furthest return .LT. 1.5m
    |          . .        .           . .     3 -- Slope hazard
    |               •     . .         .       4 -- Step  hazard
-1.0 +                    .            .       5 -- Crosspath hazard
    |                                         6 -- Bad data
    |          . .                    .
    |                                 .
    |                      . .
-2.0 +                     . .
    +----------------------------------> X
    0         1         2         3    4      Points off scale:  0
```

NO HAZARDS CATALOGED THIS SCAN

FIGURE 36. 230 CM RANGE TEST

range for the determination of step hazards was less than this. Also, since the tests were performed with level ground approximately 34 cm (14 in) below what would be vehicle ground, the effective range for the determination of hazards was actually on the order of 200 cm (78 in).

4.7 Holes Tests

All of the above tests ignore a family of obstacles which must be considered: holes. This test consists of creating a hole in an otherwise flat terrain and seeing how well the modeler recognizes the danger. The hole opening was was either a small square 30 cm by 30 cm (12 in by 12 in), a rectangle, 30 cm by 60 cm (12 by 24 in), or a large square, 60 cm by 60 cm (24 in by 24 in). For each of these, the depths were set to 0, 10, 20, 25, 30, and 36 cm (0, 4, 8, 10, 12, 14 in). In each case, the distance from the edge of the hole to the mast was 86 cm (34 in). Results from the hole tests are given in Appendix Section 7.2.6. For the discussion that follows, references to the falling edge are to the edge closest to the mast, and references to the rising edge are to the edge furthest from the mast.

As can be seen in Figure 37, with the small hole a hazard was not detected until the hole was 30 cm deep (which was 5 cm greater than the step hazard threshold). The hazard detected with this depth was only at one point in the hole even though there were actually

Input file: MDL.LITTLE.HOLE.12
File Creation Date : MON, AUG 08 1983   System time   20:15:21

```
          **  MODEL PARAMETERS  *
     HEIGHT FILTER COEFFICIENT =        0.25
     SLOPE FILTER COEFFICIENT =         0.90
     LEVEL GROUND STEP THRESHOLD =      0.25 METERS
     SLOPE THRESHOLD =                  30.00 DEGREES
```

```
2.0 +                        ..
    |                     ..
    |                 ..       .
1.0 +                            X vs. Y for
    |             ..             hazards of
    |         ..     4       .   scan #  1
0.0 +         .                  Number key:
    |         .         .        1 -- Insufficient data
    |         .         .        2 -- Furthest return .LT. 1.5m
    |         ..                 3 -- Slope hazard
-1.0 +               .           4 -- Step  hazard
    |         ..                 5 -- Crosspath hazard
    |             ..             6 -- Bad data
-2.0 +      .       ..
    ----------------------------> X     Points off scale:  0
    0     1     2     3     4
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	N O	H A Z A R D S	C A T A L O G E D		
16	-1.41	N O	H A Z A R D S	C A T A L O G E D		
17	1.40	N O	H A Z A R D S	C A T A L O G E D		
18	4.21	N O	H A Z A R D S	C A T A L O G E D		
19	7.02	N O	H A Z A R D S	C A T A L O G E D		
20	9.83	N O	H A Z A R D S	C A T A L O G E D		
21	12.64	N O	H A Z A R D S	C A T A L O G E D		
22	15.45	1.45	1.39	0.39	-0.28	Step hazard
		1.45	1.39	0.39	-0.28	Step hazard
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

FIGURE 37. SMALL SQUARE HOLE WITH 30 CM DEPTH TEST

hazards at both the falling and rising edges of the hole. In the case of a 36 cm (14 in) deep hole (see Figure 38), both the falling and rising edges of the hole were detected. Because of the orientation of the detector array, falling edge of the hole was detected several centimeters into the hole. The fact that the hole was not seen until it was 30 cm (12 in) deep brings out an important problem; that a wheel could quite easily get stuck in a hole which went unreported by the vision system. Setting a lower step threshold value, at say 20 centimeters (8 inches), would cure the problem, but would cause the vehicle to be more cautious than necessary most of the time.

For the rectangular hole, a step hazard was first recognized at a hole depth of 25 cm (10 in) (Figure 39). Unfortunately, only the rising edge of the hole was recognized as a hazard. At a depth of 30 cm (12 in) as in Figure 40, the falling edge step was recognized at about the center of the hole. As with the little square hole, this was due to the detector array position. When the hole depth was increased to 36 cm (14 in) (Figure 41), the position of the detected falling edge of the hole was moved closer to its actual position.

The test results using a large hole were quite interesting. For one thing (see Figure 42), a hole 20 cm deep (8 in) produced a hazard at the rising edge of the hole even though the step threshold was 25 cm (10 in). The reason for this is not readily apparent, but it may be due to reflections from the back of the hole hitting the bottom and then reflecting back at the detector array (see Figure 43.

Input file: MDL.LITTLE.HOLE.14
File Creation Date : MON, AUG 08 1983   System time   20:25:22

** MODEL1 PARAMETERS **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
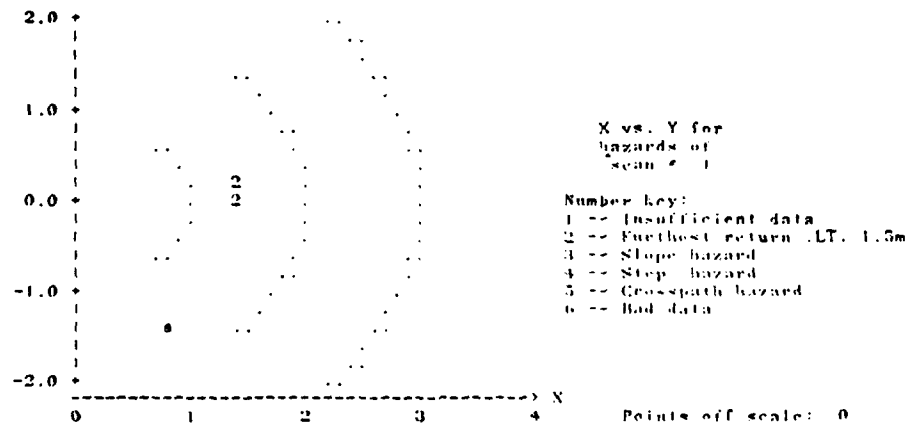SLOPE THRESHOLD =   30.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	NO	H A Z A R D S	C A T A L O G E D		
2	-40.74	NO	H A Z A R D S	C A T A L O G E D		
3	-37.93	NO	H A Z A R D S	C A T A L O G E D		
4	-35.13	NO	H A Z A R D S	C A T A L O G E D		
5	-32.31	NO	H A Z A R D S	C A T A L O G E D		
6	-29.50	NO	H A Z A R D S	C A T A L O G E D		
7	-26.69	NO	H A Z A R D S	C A T A L O G E D		
8	-23.88	NO	H A Z A R D S	C A T A L O G E D		
9	-21.08	NO	H A Z A R D S	C A T A L O G E D		
10	-18.26	NO	H A Z A R D S	C A T A L O G E D		
11	-15.45	NO	H A Z A R D S	C A T A L O G E D		
12	-12.64	NO	H A Z A R D S	C A T A L O G E D		
13	-9.84	NO	H A Z A R D S	C A T A L O G E D		
14	-7.02	NO	H A Z A R D S	C A T A L O G E D		
15	-4.22	NO	H A Z A R D S	C A T A L O G E D		
16	-1.41	NO	H A Z A R D S	C A T A L O G E D		
17	1.40	1.06	1.06	0.03	0.01	Step hazard
		1.41	1.41	0.03	-0.25	Step hazard
18	4.21	1.06	1.05	0.08	0.01	Step hazard
		1.41	1.40	0.10	-0.25	Step hazard
		1.41	1.40	0.10	-0.25	Step hazard
		1.41	1.40	0.10	-0.25	Step hazard
19	7.02	1.06	1.05	0.13	0.01	Step hazard
		1.41	1.40	0.17	-0.25	Step hazard
		1.41	1.40	0.17	-0.25	Step hazard
20	9.83	1.06	1.04	0.18	0.01	Step hazard
		1.41	1.39	0.24	-0.25	Step hazard
21	12.64	1.06	1.03	0.23	0.01	Step hazard
		1.41	1.37	0.31	-0.25	Step hazard
22	15.45	1.10	1.06	0.29	0.00	Step hazard
		1.41	1.36	0.37	-0.25	Step hazard
23	18.26	NO	H A Z A R D S	C A T A L O G E D		
24	21.07	NO	H A Z A R D S	C A T A L O G E D		
25	23.88	NO	H A Z A R D S	C A T A L O G E D		
26	26.69	NO	H A Z A R D S	C A T A L O G E D		
27	29.50	NO	H A Z A R D S	C A T A L O G E D		
28	32.31	NO	H A Z A R D S	C A T A L O G E D		
29	35.12	NO	H A Z A R D S	C A T A L O G E D		
30	37.93	NO	H A Z A R D S	C A T A L O G E D		
32	43.55	NO	H A Z A R D S	C A T A L O G E D		

FIGURE 38. SMALL SQUARE HOLE WITH 36 CM DEPTH TEST

Input file: MDL.MIDDLE.HOLE.10
File Creation Date : MON. AUG 08 1983   System time   21:52:50

```
          **  MODEL1 PARAMETERS  **
     HEIGHT FILTER COEFFICIENT :        0.25
     SLOPE FILTER COEFFICIENT  =        0.90
     LEVEL GROUND STEP THRESHOLD =      0.25 METERS
     SLOPE THRESHOLD =                 30.00 DEGREES
```

```
2.0 +                        . .
    |                              .  .
    |                     . .              .
1.0 +                                        .
    |                  . .                     .          X vs. Y for
    |            . .          . .              .          hazards of
    |                    44              .                  scan #  1
0.0 +                                        .
    |                                        .          Number key:
    |                                        .          1 -- Insufficient data
    |            . .                        .           2 -- Furthest return .LT. 1.5m
    |                  . .              . .              3 -- Slope hazard
-1.0 +                     .                             4 -- Step  hazard
    |                  . .          . .                 5 -- Crosspath hazard
    |                        . .                        6 -- Bad data
    |                  . .
-2.0 +                     . .
    +-----------------------------------------> X
    0        1        2        3        4       Points off scale:  0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O H A Z A R D S C A T A L O G E D				
2	-40.74	N O H A Z A R D S C A T A L O G E D				
3	-37.93	N O H A Z A R D S C A T A L O G E D				
4	-35.13	N O H A Z A R D S C A T A L O G E D				
5	-32.31	N O H A Z A R D S C A T A L O G E D				
6	-29.50	N O H A Z A R D S C A T A L O G E D				
7	-26.69	N O H A Z A R D S C A T A L O G E D				
8	-23.88	N O H A Z A R D S C A T A L O G E D				
9	-21.08	N O H A Z A R D S C A T A L O G E D				
10	-18.26	N O H A Z A R D S C A T A L O G E D				
11	-15.45	N O H A Z A R D S C A T A L O G E D				
12	-12.64	N O H A Z A R D S C A T A L O G E D				
13	-9.84	N O H A Z A R D S C A T A L O G E D				
14	-7.02	N O H A Z A R D S C A T A L O G E D				
15	-4.22	N O H A Z A R D S C A T A L O G E D				
16	-1.41	N O H A Z A R D S C A T A L O G E D				
17	1.40	N O H A Z A R D S C A T A L O G E D				
18	4.21	N O H A Z A R D S C A T A L O G E D				
19	7.02	N O H A Z A R D S C A T A L O G E D				
20	9.83	N O H A Z A R D S C A T A L O G E D				
21	12.64	1.55	1.51	0.34	-0.22	Step hazard
22	15.45	1.48	1.43	0.39	-0.26	Step hazard
		1.48	1.43	0.39	-0.26	Step hazard
23	18.26	N O H A Z A R D S C A T A L O G E D				
24	21.07	N O H A Z A R D S C A T A L O G E D				
25	23.88	N O H A Z A R D S C A T A L O G E D				
26	26.69	N O H A Z A R D S C A T A L O G E D				
27	29.50	N O H A Z A R D S C A T A L O G E D				
28	32.31	N O H A Z A R D S C A T A L O G E D				
29	35.12	N O H A Z A R D S C A T A L O G E D				
30	37.93	N O H A Z A R D S C A T A L O G E D				
31	40.74	N O H A Z A R D S C A T A L O G E D				
32	43.35	N O H A Z A R D S C A T A L O G E D				

FIGURE 39. RECTANGULAR HOLE WITH 25 CM DEPTH TEST

Input file: MDL.MIDDLE.HOLE.12
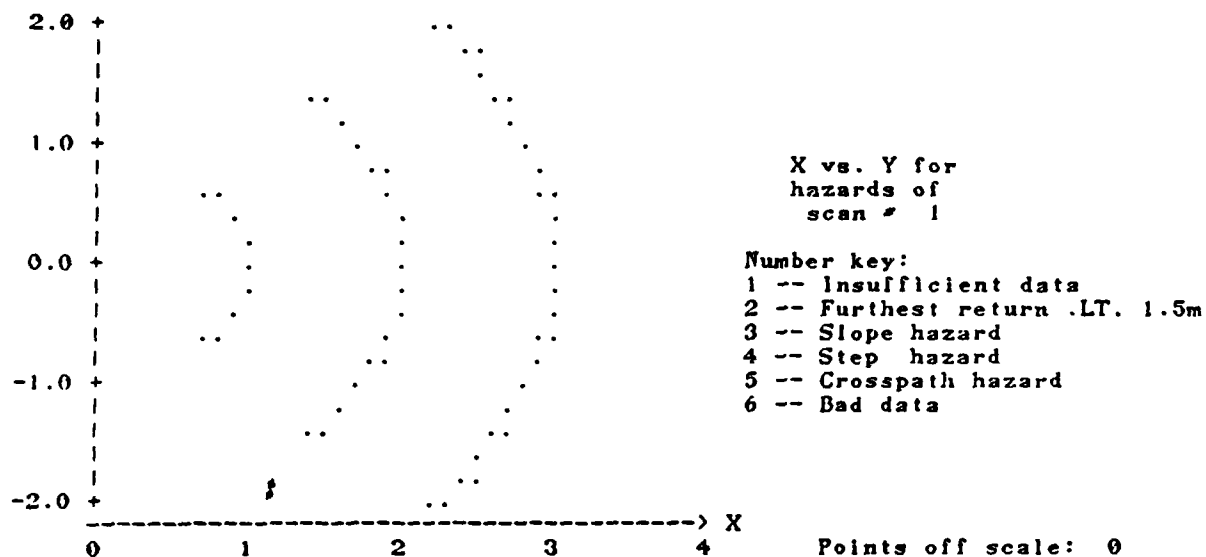File Creation Date : MON, AUG 08 1983   System time   21:22:45

```
            **  MODEL: PARAMETERS  **
        HEIGHT FILTER COEFFICIENT =        0.25
        SLOPE FILTER COEFFICIENT  =        0.90
        LEVEL GROUND STEP THRESHOLD =      0.25 METERS
        SLOPE THRESHOLD =                  30.00 DEGREES
```
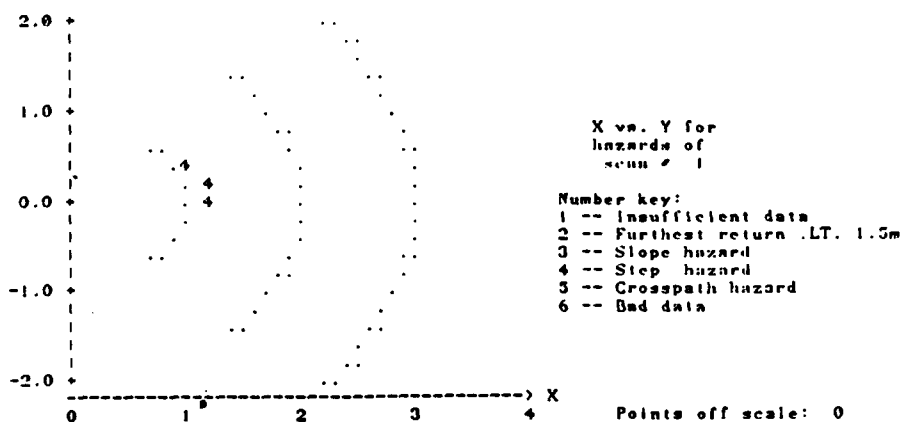
```
2.0 +
    |                        . .
    |                 . .              . . .
    |               . .                    . .
1.0 +             . .                        . .
    |            .                             .        X vs. Y for
    |          .           . .                  .       hazards of
    |          .         44 4                    .      scan #  1
0.0 +          .         444                      .
    |          .         5                        .     Number key:
    |          .                                  .     1 -- Insufficient data
    |           .                                .      2 -- Furthest return .LT. 1.5m
    |           . .                              .      3 -- Slope hazard
-1.0 +           .                     . .      .       4 -- Step  hazard
    |             . .                          .        5 -- Crosspath hazard
    |               . .                      . .        6 -- Bad data
    |                 . .                  . .
-2.0 +                     . .          . .
    ----------------------------------------------> X
    0         1         2         3         4          Points off scale:  0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	N O	H A Z A R D S	C A T A L O G E D		
16	-1.41	1.50	1.50	-0.04	0.05	Crosspath hazard
17	1.40	N O	H A Z A R D S	C A T A L O G E D		
18	4.21	N O	H A Z A R D S	C A T A L O G E D		
19	7.02	1.56	1.53	0.19	-0.32	Step hazard
		1.71	1.70	0.21	-0.29	Step hazard
20	9.83	1.56	1.54	0.27	-0.32	Step hazard
		1.71	1.68	0.29	-0.30	Step hazard
		1.71	1.68	0.29	-0.30	Step hazard
21	12.64	1.59	1.55	0.35	-0.27	Step hazard
		1.71	1.67	0.37	-0.29	Step hazard
22	15.45	1.43	1.39	0.39	-0.28	Step hazard
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

FIGURE 40. RECTANGULAR HOLE WITH 30 CM DEPTH TEST

Input file: MDL.BIG.HOLE.14
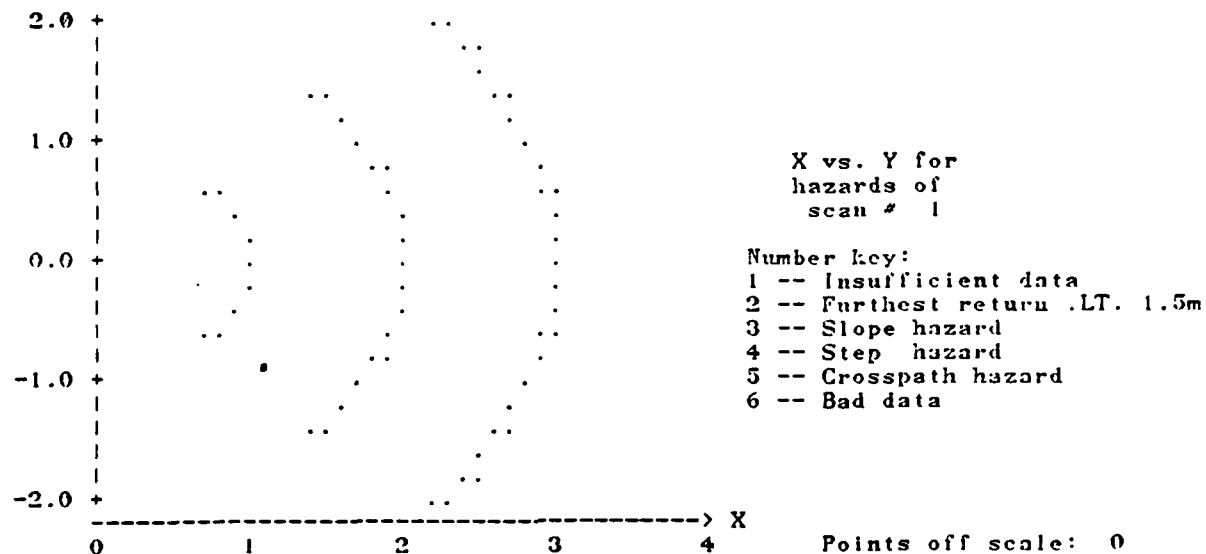File Creation Date : MON, AUG 08 1983   System time   22:37:30

```
            **  MODEL1 PARAMETERS  **
    HEIGHT FILTER COEFFICIENT :         0.25
    SLOPE FILTER COEFFICIENT :          0.90
    LEVEL GROUND STEP THRESHOLD :       0.25 METERS
    SLOPE THRESHOLD :                  30.00 DEGREES
```


AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	R A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	1.41	1.36	-0.37	-0.28	Step hazard
12	-12.64	1.06	1.03	-0.23	0.01	Step hazard
		1.61	1.57	-0.35	-0.38	Step hazard
		1.61	1.57	-0.35	-0.38	Step hazard
		1.61	1.57	-0.35	-0.38	Step hazard
		1.68	1.64	-0.37	-0.35	Step hazard
13	-9.84	1.06	1.04	-0.18	0.01	Step hazard
		1.86	1.83	-0.32	-0.37	Step hazard
14	-7.02	1.06	1.03	-0.13	0.01	Step hazard
		1.61	1.60	-0.20	-0.38	Step hazard
		1.68	1.67	-0.21	-0.35	Step hazard
15	-4.22	1.06	1.05	-0.08	0.01	Step hazard
		1.61	1.61	-0.12	-0.38	Step hazard
		1.61	1.61	-0.12	-0.38	Step hazard
		1.68	1.67	-0.12	-0.35	Step hazard
16	-1.41	1.06	1.06	-0.03	0.01	Step hazard
		1.68	1.68	-0.04	-0.35	Step hazard
		1.77	1.77	-0.04	-0.37	Step hazard
17	1.40	1.64	1.64	0.04	-0.37	Step hazard
18	4.21	1.64	1.64	0.12	-0.37	Step hazard
		1.84	1.83	0.13	-0.13	Step hazard
19	7.02	1.61	1.60	0.20	-0.38	Step hazard
		1.61	1.60	0.20	-0.38	Step hazard
		1.77	1.75	0.22	-0.31	Step hazard
20	9.83	1.06	1.04	0.18	0.01	Step hazard
		1.61	1.59	0.28	-0.38	Step hazard
		1.61	1.59	0.28	-0.38	Step hazard
		1.68	1.65	0.29	-0.35	Step hazard
21	12.64	1.06	1.03	0.23	0.01	Step hazard
		1.86	1.81	0.41	-0.37	Step hazard
22	15.45	1.06	1.02	0.28	0.01	Step hazard
23	18.26	N O	R A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

FIGURE 41. RECTANGULAR HOLE WITH 36 CM DEPTH TEST

Input file: MDL.BIG.POLE.08
File Creation Date : MON, AUG 03 1983   System time   23:00:51

```
              MODEL PARAMETERS
      HEIGHT FILTER COEFFICIENT       0.25
      SLOPE FILTER COEFFICIENT        0.90
      LEVEL GROUND STEP THRESHOLD     0.25 METERS
      SLOPE THRESHOLD                30.00 DEGREES
```

```
2.0 +

1.0 +                                            X vs. Y for
                                                 hazards of
                                                 scan # 1
0.0 +                                         Number Key:
                                                 1 -- Insufficient data
                                                 2 -- Furthest return .LT. 1.5m
                                                 3 -- Slope hazard
-1.0 +                                           4 -- Step  hazard
                                                 5 -- Crosspath hazard
                                                 6 -- Bad data
-2.0 +
     ------------------------------> X
     0    1    2    3    4        Points off scale:  0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	1.53	1.51	-0.34	-0.21	Step hazard
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	1.71	1.71	-0.13	-0.25	Step hazard
16	-1.41	N O	H A Z A R D S	C A T A L O G E D		
17	1.40	N O	H A Z A R D S	C A T A L O G E D		
18	4.21	N O	H A Z A R D S	C A T A L O G E D		
19	7.02	N O	H A Z A R D S	C A T A L O G E D		
20	9.83	N O	H A Z A R D S	C A T A L O G E D		
21	12.64	1.71	1.67	0.37	-0.25	Step hazard
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

FIGURE 42. LARGE SQUARE HOLE WITH 20 CM DEPTH TEST
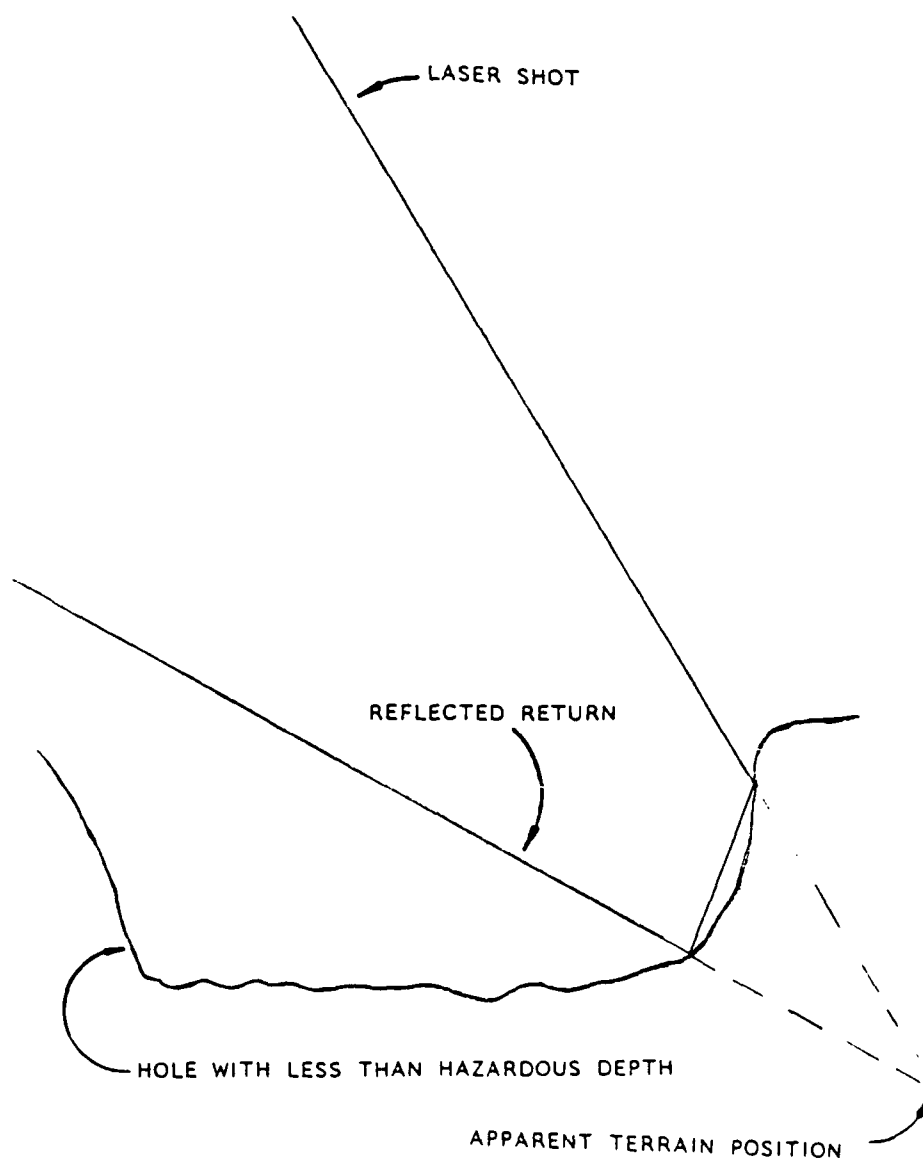
FIGURE 43. FALSE RETURN DUE TO REFLECTION

It may also be due to one of the malfunctioning detectors mentioned above. The falling edge was detected when the depth was increased to 30 cm (12 in) shown in Figure 44. As the depth became deeper, the detected distance to the falling edge became closer to its actual position.

When the results obtained with the large hole are placed next to those obtained for the small hole, a potential problem becomes apparent. Specifically, in order to detect a hazard when the small area top hole was present, the depth had to be 5 cm (2 in) deeper than the threshold level. On the other hand, when the large area top hole was present, a hazard was first detected when the depth was 5 cm (2 in) less than the threshold level although this may have been due to conditions which would not have been present if all detectors were working properly. This implies that for the worst case to be accounted for, the threshold would have to be lowered. Unfortunately, this could create a very conservative system if small holes were rarely the hazard sources. Also, since this type of problem did not exist for positive step hazards, there would be several false alarms if a majority of the obstacles present were positive step. One way to alleviate this problem is to have separate threshold levels for positive and negative steps. To date, however, no testing has been done using that criterion.

Input file: MDL.BIG.HOLE.12
File Creation Date : MON, AUG 08 1983   System time   22:45:28

== MODELS PARAMETERS ==
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.70
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
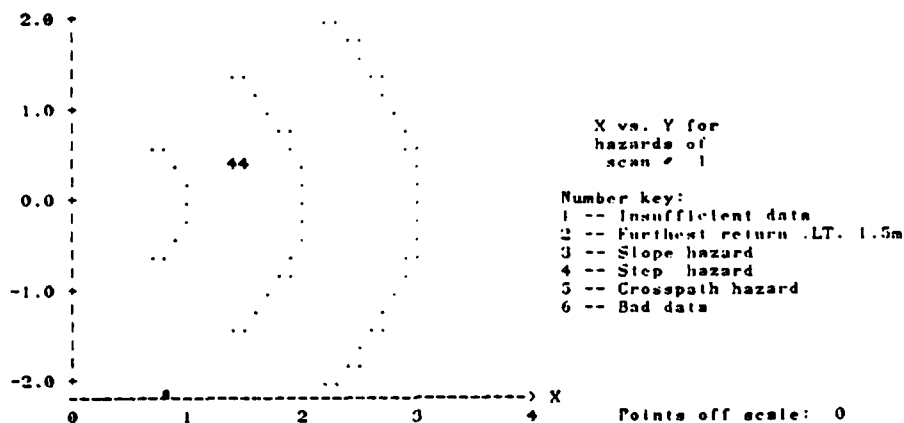SLOPE THRESHOLD =   30.00 DEGREES

```
2.0 +                    ..
    |                          . .
    |                  ..          .
    |                   .           .
1.0 +            .          .
    |                ..                  .
    |      ..        44 4 .               .
    |                   4
0.0 +        .4                           .
    |        .4         4                 .
    |      ..           45  .             .
    |             .                    ..
-1.0 +            .          .
    |                   .           .
    |                  ..          .
    |                          . .
-2.0 +                    ..
    ----------------------------------------> X
    0       1        2        3        4        Points off scale:  0
```

X vs. Y for
hazards of
scan # 1

Number Key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	1.75	1.69	-0.47	0.01	Crosspath hazard
12	-12.64	1.68	1.64	-0.37	-0.31	Step hazard
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	1.10	1.10	-0.13	0.00	Step hazard
		1.68	1.67	-0.21	-0.33	Step hazard
15	-4.22	1.10	1.10	-0.08	0.00	Step hazard
		1.68	1.67	-0.12	-0.33	Step hazard
16	-1.41	N O	H A Z A R D S	C A T A L O G E D		
17	1.40	N O	H A Z A R D S	C A T A L O G E D		
18	4.21	N O	H A Z A R D S	C A T A L O G E D		
19	7.02	1.68	1.67	0.21	-0.29	Step hazard
20	9.83	N O	H A Z A R D S	C A T A L O G E D		
21	12.64	1.59	1.55	0.35	-0.28	Step hazard
		1.71	1.67	0.37	-0.29	Step hazard
22	15.45	1.43	1.39	0.39	-0.28	Step hazard
		1.45	1.39	0.39	-0.28	Step hazard
		1.48	1.43	0.39	-0.28	Step hazard
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

FIGURE 44. LARGE SQUARE HOLE WITH 30 CM DEPTH TEST

PART 5

CONCLUSIONS

As the results of the tests have shown, the ML/MD vision scanning system has the potential to do an excellent job of supplying hazard data for an autonomous roving vehicle. All height data obtained were within a few centimeters of the actual heights involved. Step hazards were detected without any problems. Cross-path analysis showed that a cross-step hazard is detected when present. The side to side resolution proved to be quite good as shown in the cross-path testing. The obstacle disappeared and a step hazard appeared at the appropriate heights. Also, although some hazards are not cataloged, such as cross-slope hazards, the data obtained by the mast certainly provided enough information for the presence of additional hazards to be derived.

Of course, there are problems. The first of these is that a hazard is not flagged when two obstacles were placed at a width less than the vehicle width.

This problem is not considered an impossible stumbling block since the path selection algorithm could be set up to recognize this as a hazard and the appropriate action could then be taken; specifically, the terrain could be avoided.

Another problem which became obvious was that the ranges determined during the range tests proved to be different from the actual ranges involved. Fortunately, the differences were about the same for both rising and falling edges for all detectable range values. Injecting an offset into the range values obtained would alleviate this problem. Since the values varied by about 5 cm (2 in), it seems that it would be necessary to always assume that a hazard occupies space outside of its detected edges by this amount. This could also be taken care of by the path selection algorithm.

Cross-path hazards is a problem which was not fully explored here but which must be given greater attention in the future. The cross-path results obtained here involved cross-steps between adjacent azimuths. Unfortunately, the ability of the modeler to detect cross-slopes is very limited. This is because the cross-path analysis is performed between adjacent azimuths and a cross-slope hazard would generally occur amongst azimuths much more than 1 apart. Fortunately, the data obtained contains enough information for a proper analysis to be done.

A problem which showed itself during the slope hazard tests was the inability of the modeler to reliably detect a slope hazard. Looking at the data reveals that all of the information is available to perform reasonably accurate slope hazard analysis, but the results which the modeler produced did not reflect this. Specifically, the software lowpass filtering which the data experiences, discussed in Section 3.5.4, all but destroys the data. If the slope filter coefficient is too high, most of the slope information is lost. However, if the coefficient is just slightly lower, almost any terrain produces a slope hazard. What the problem seems to be is that since slopes are determined from information obtained from adjacent valid elevations, the actual envelope of the terrain is distorted. In fact, there is never enough information when a slope starts gradually or when the slope does not occupy the entire view in front of the mast for a detectable slope hazard to materialize. What is proposed to correct this is to fit the data obtained to straight lines, each created by doing a least squares fit of the data on at least one-fourth of the data obtained for any particular azimuth.

In terms of the ML/MD systems's useful range resolution, another comment must be made. In order for a hazard to be detected, enough data for the terrain surrounding that hazard must be obtained. The vision system's ability to detect hazards greater than 2 meters in range is non-existent, at least on what the vehicle would consider level ground. This is because the most distant laser shot is

fired at a point approximately 3 meters away from the mast. This, coupled with the facts that the effective detector height is only 1 meter and at a distance of 2 meters the detectors cannot see anything above about 30 cm over the ground plane precludes the hazard detection ability beyond this. Of course, holes could be detected at a somewhat further distance, but the concern should be with worst case, not best.

All of these problems are not really that bad and for the most part are correctable through changes and additions in the software. The slope hazard detection algorithm will almost certainly have to be looked at and corrections in the modeler is almost inevitable. The problem with detecting cross-slope cross-path hazards is currently being looked at and will probably be corrected within the modeler. The path selection routine could certainly correct for the problem with narrow passages as well as considering an object as larger than it actually is. In terms of the limited range which the vision system possesses, this could be corrected without loss of resolution by increasing the number of detectors and the number of laser shots fired per azimuth. Of course, this would mean an increased load on the interpretation software, but given the advances in computer and microprocessor technology, this would not be a problem.

In conclusion, the data obtained by the Multi-Laser/Multi-Detector mast electronics provides useful information to help in the determination of the hazards on a given terrain. Also,

with just a few changes and additions to the software, a fast but nominally performing, short-range hazard detection system could be made completely functional. Finally, with some additional changes to hardware, the range of this vision system could also be increased.

PART 6

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PART 7

APPENDIX

7.1 TELEM6.TC - Microprocessor Telemetry Program

MOTOROLA M68SAM CROSS-ASSEMBLER   PAGE 1

MOTOROLA M6800 CROSS ASSEMBLER, RELEASE 1.2

```
00001                 NAM    TELEM6.TC   M6802 telemetry gathering program
00002
00003        *         TELEMETRY   LASER & VEHICLE DATA TO MICRO TO ADLC
00004        *
00005        *    T Clement    21 Sept 1982
00006        *    Revised:     Clears out shared RAM locations before
00007        *                   starting to send data.   TJC   06 June  1983
00008        *    Revised:     Prints the number of shots per azimuth,
00009        *                   and total shots per scan. TJC  12 July 1983
00010        *
00011        *    Used on Telemetry Board with 6802 Microprocessor
00012        *    RO data is inverted
00013        ************************************************************
00014        *
00015        *    Data is printed to the screen as follows:
00016        *
00017        *   (1)  When End of vehicle is being sent, a period (.) is printed.
00018        *
00019        *   (2)  When an End of azimuth is received (zz:zz) is printed
00020        *        where:   zz:zz
00021        *                 || '--->>> is the number of laser shots fired
00022        *                 '--->>> is the azimuth number
00023        *
00024        *   (3)  When End of Scan is sent, (EOS zz zzzz) is printed
00025        *        where: EOS zz zzzz
00026        *                   || '--.--->>> is total number of laser shots fired
00027        *                   '--->>> is the total number of azimuths
00028        *
00029        *
00030        *    Data should look something like this on the screen:
00031        *
00032        *  .....00:32.01:32.02:32.03:32.04:32.  (etc)
00033        *
00034        *  25:32.26:32.27:32.28:32.29:32.30:32.31:32
00035        *                                          EOS 32 1024
00036        *  ......00:32.  (etc)
00037        *
00038        ************************************************************
00039  A200  START    EQU    $A200          - Starting address
00040  A0FF  STACK    EQU    $A0FF          - Top of stack
00041
00042  5550  ADLC     EQU    $5550          WRITE - Control register for ADLC
00043  5550  SADLC    EQU    $5550          READ  - Status register for ADLC
00044  5552  DADLC    EQU    $5552          WRITE - Data register in ADLC
```

```
TYLE96              MOTOROLA M68SAM CROSS-ASSEMBLER           PAGE  2

00045   5553        LDADLC  EQU   $5553       WRITE - Control and last data registers in ADLC
00046   5558        FIFO    EQU   $5558       WRITE - Causes release of FIFO latch
00047   555B        HBLASA  EQU   $555B       READ  - Location of high byte of laser address
00048               *
00049   555A        HBLASD  EQU   $555A       READ  - Location of low byte of laser address
00050   555D                      $555D       READ  - Location of high byte of laser data
00051   555C        FIFOT   EQU   $555C       READ  - location for test for FIFO ready
00052               *
00053   A1F2        ELVCNT  EQU   $A1F2       R/WR  - Contains number of shots in an Azimuth
00054   A1F3        AZMCNT  EQU   $A1F3       R/WR  - Contains number of Azimuths
00055   A1F4        TOSHOT  EQU   $A1F4       R/WR  - Contains total of number shots as of EOS
00056   A1F6        VDRTS   EQU   $A1F6       R/WR  - Vehicle Data Ready To Send Flag
00057   A1F8        HBADDR  EQU   $A1F8       R/WR  - Temp. loc. for high byte of output address
00058   A1F9        LBADDR  EQU   $A1F9       R/WR  - Temp. loc. for low byte of output address
00059   A1FA        HBDATA  EQU   $A1FA       R/WR  - Temp. loc. for high byte of output data
00060   A1FB        LBDATA  EQU   $A1FB       R/WR  - Temp. loc. for low byte of output data
00061   A1FC        TEMP1   EQU   $A1FC       R/WR  - Location for shared RAM address
00062   A1FE        TEMP2   EQU   $A1FE       R/WR  - Location for block address
00063               *
00064   A700        BLKSTR  EQU   $A700       R/WR  - Location where block sta... s
00065               *
00066   C400        AVDATA  EQU   $C400       R/WR  - Starting location of analog vehicle data
00067                                               - ends at $C41F
00068   C420        DVDATA  EQU   $C420       R/WR  - Starting location of digital vehicle data
00069                                               - ends at $C43F
00070   C43E        LBDVDA  EQU   $C43E       R/WR  - Location of last word of vehicle data
00071   C440        VDATAT  EQU   $C440       R/WR  - Location to test if vehicle data ready
00072               *
00073               *
00074   A200                ORG   START
00075               *
00076               * Set up stack
00077               *
00078   A200 8E A0FF        LDS   #STACK
00079               *
00080               * Set up loop to clear vehicle data.
00081               *
00082   A203 CE C400        LDX   #AVDATA
00083               *
00084               * Clear vehicle data.
00085               *
00086   A206 6F 00  CLOOP   CLR   0,X
00087   A208 08             INX
00088               *
00089               * Test if done.
00090               *
00091   A209 BC C440        CPX   #VDATAT
00092               * Branch back if not.
00093               *
```

```
000094  A29C 26 F8      *         BNE   CLOOP
000095
000096          * Set vehicle test word to allow vehicle data to be read
000097          * at least once.
000098
000099
000100  A29E 7F C440              CLR   VDATAT
000101  A2A1 7C C440              INC   VDATAT
000102
000103          * Initialize ADLC
000104
000105  A2A4 CE 5550              LDX   #ADLC        Starting address for ADLC
000106  A2A7 86 D9                LDA A #$D9         Reset TX, RX, TDSR, Disable interrupts, AC=1
000107  A2A9 A7 00                STA A 0,X          CR1
000108  A2AB 4F                   CLR A
000109  A2AC A7 01                STA A 1,X          CR2
000110  A2AE 86 1F                LDA A #$1F
000111  A2B0 A7 03                STA A 3,X          CR4
000112  A2B2 86 D8                LDA A #$D8         AC=0
000113  A2B4 A7 00                STA A 0,X          CR1
000114  A2B6 86 04                LDA A #$04         Idle ones
000115  A2B8 A7 01                STA A 1,X          CR2
000116  A2BA 86 58                LDA A #$58         Set TX eenable
000117  A2BC A7 00                STA A 0,X          CR1
000118
000119                  *         Initialize:
000120
000121  A2BE 7F A1F2              CLR   ELVCNT       .
000122  A2C1 7F A1F3              CLR   AZMCNT       .
000123  A2C4 7F A1F4              CLR   TOSHOT
000124  A2C7 7F A1F5              CLR   TOSHOT+1
000125
000126  A2CA 6F 00                CLR   8,X          Release FIFO latch
000127
000128  A2CC CE 0000              LDX   #0           Clear VDBITS
000129  A2CF FF A1F6              STX   VDBITS
000130
000131                  *         Read laser address and data words
000132
000133  A2D2 F6 533C      TOP     LDA B FIFOT       Fifos ready
000134  A2D5 54                   LSR B
000135  A2D6 25 03                BCS   LASER
000136  A2D8 7E A2D2              JMP   VDRDY
000137
000138  A2DB FE 5550      LASER   LDX   HHLASA       Read High and low laser address words
000139  A2DE FF A1F0              STX   HHRADDR
000140  A2E1 FE 5551              LDX   HHLASD       Read High and low laser data words
000141  A2E4 FF A1F1              STX   HHDATA
000142
```

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```
00143 A257 7F 555B          CLR    FIFO      Release FIFO latch
00144                  *
00145 A25A B6 A1F2          LDA A  ELVCNT    Increment elevation count.
00146 A25D 8B 01            ADD A  #1
00147 A25F 19               DAA
00148 A260 B7 A1F2          STA A  ELVCNT
00149                  *
00150 A263 B6 A1FB          LDA A  HBADDR    Put high byte of laser address in proper format
00151 A266 84 7F            AND A  #$7F
00152 A268 8A 10            ORA A  #$10
00153 A26A B7 A1FB          STA A  HBADDR
00154                  *
00155 A26D BD A3ED          JSR    SEND      Put address and data in ADLC
00156 A270 B6 A1FB          LDA A  HBADDR
00157 A273 85 20            BIT A  #$20      Test for EOA
00158 A275 26 0D            BNE    NEXT      Branch if end-of-azimuth (or EOS).
00159                  *
00160 A277 F6 555C  WAITL1  LDA B  FIFOT     Test if laser data is ready
00161 A27A 54               LSR B
00162 A27B 25 CE            BCS    LASER
00163 A27D 20 FB            BRA    WAITL1
00164                  *
00165 A27F B6 A1F3  NEXT    LDA A  AZMCNT    Increment number of azimuths.
00166 A282 8B 01            ADD A  #1
00167 A284 19               DAA
00168 A285 B7 A1F3          STA A  AZMCNT
00169                  *
00170                  *
00171                  *               Print azimuth #, # of azimuths, & # of elevations
00172 A288 B6 A1FB          LDA A  HBADDR    Load most significant byte of address
00173 A28B F6 A1F9          LDA B  LBADDR    Load least significant byte of address
00174 A28E 58               ASL B
00175 A28F 49               ROL A
00176 A290 58               ASL B
00177 A291 49               ROL A
00178                  *
00179                  *
00180                  *               Pull out data to allow conversion to BCD
00181 A292 84 1F            AND A  #$1F
00182 A294 16               TAB
00183 A295 84 0F            AND A  #$0F
00184                  *
00185 A297 81 0A            CMP A  #10
00186 A299 2D 04            BLT    NOADJ
00187                  *
00188 A29B 80 0A            SUB A  #10
00189 A29D 8A 10            ORA A  #$10
00190                  *
00191 A29F C5 10  NOADJ     BIT B  #$10
```

```
TELIM6              MOTOROLA M6800M CROSS-ASSEMBLER          PAGE  5

00192 A2A1 27 03       BEQ  NOADD       Account for bit 5?? (As per MAST.TM)
00193
00194 A2A3 8B 16       ADD A  #$16
00195 A2A5 19          DAA
00196
00197 A2A6 16    NOADD TAB              Print angle number
00198 A2A7 BD E0FA     JSR  $E0FA       High nibble
00199 A2AA 17          TBA
00200 A2AB BD E0FE     JSR  $E0FE       Low nibble
00201
00202 A2AE 86 3A       LDA A  #':'      Print a separator character to allow //;;
00203 A2B0 BD E10B     JSR  $E10B
00204
00205                                   Add current number of shots to total............
00206
00207 A2B3 B6 A1F2     LDA A  ELVCNT    First get the elevation count and add it to the
00208 A2B6 F6 A1F5     LDA B  TOSHOT+1
00209 A2B9 1B          ABA
00210 A2BA 19          DAA             Be sure to decimal adjust this.
00211 A2BB B7 A1F5     STA A  TOSHOT+1
00212
00213 A2BE B6 A1F4     LDA A  TOSHOT    Then add the carry to the upper byte.
00214 A2C1 B9 00       ADC A  #0
00215 A2C3 19          DAA             Be sure to decimal adjust this.
00216 A2C4 B7 A1F4     STA A  TOSHOT
00217
00218 A2C7 B6 A1F2     LDA A  ELVCNT    Print number of elevation shots
00219 A2CA BD E0FA     JSR  $E0FA
00220 A2CD B6 A1F2     LDA A  ELACNT
00221 A2D0 BD E0FE     JSR  $E0FE
00222
00223 A2D3 7F A1F2     CLR  ELVCNT      Clear number of elevation shots
00224
00225                                   Test for End of Scan
00226
00227 A2D6 CE 0000     LDX  #0          Clear VDRDY
00228 A2D9 FF A1F6     STX  VDRTS
00229
00230 A2DC B6 A1FB     LDA A  HBADDR    Test for end of scan
00231 A2DF 48          ASL A
00232 A2E0 2A 5B       BPL  VDRDY.      Branch if not
00233
00234                                   Print 'EOS', # of azimuths, and total # of shots
00235
00236 A2E2 86 0A       LDA A  #$0A      Print a line feed.
00237 A2E4 BD E10B     JSR  $E10B
00238
00239 A2E7 86 45       LDA A  #'E'      Print an 'E'
00240 A2E9 BD E10B     JSR  $E10B
```

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```
00241                          *
00242  A2EC  B6 4F       LDA A   #'O       Print an 'O'
00243  A2EE  BD E108             JSR   $E108
00244                          *
00245  A2F1  86 53       LDA A   #'S       Print an 'S'
00246  A2F3  BD E108             JSR   $E108
00247                          *
00248  A2F6  86 20       LDA A   #$20      Print a space
00249  A2F8  BD E108             JSR   $E108
00250                          *
00251  A2FB  B6 A1F3     LDA A   AZMCNT    Print number of azimuths fired
00252  A2FE  BD E0FA             JSR   $E0FA
00253  A301  B6 A1F3     LDA A   AZMCNT
00254  A304  BD E0FE             JSR   $E0FE
00255                          *
00256  A307  BD E1B0             JSR   $E1B0    Print a space
00257                          *
00258  A30A  B6 A1F4     LDA A   TOSHOT    Print total number of shots
00259  A30D  BD E0FA             JSR   $E0FA
00260  A310  B6 A1F4     LDA A   TOSHOT
00261  A313  BD E0FE             JSR   $E0FE
00262  A316  B6 A1F5     LDA A   TOSHOT+1
00263  A319  BD E0FA             JSR   $E0FA
00264  A31C  B6 A1F5     LDA A   TOSHOT+1
00265  A31F  BD E0FE             JSR   $E0FE
00266                          *
00267                          *           Get ready for a new scan
00268                          *
00269  A322  7F A1F2     CLR   FLVCNT    Clear all counters
00270  A325  7F A1F3     CLR   AZMCNT
00271  A328  7F A1F4     CLR   TOSHOT
00272  A32B  7F A1F5     CLR   TOSHOT+1
00273                          *
00274  A32E  86 0A       LDA A   #$0A      Print a line feed.
00275  A330  BD E108             JSR   $E108
00276  A333  86 0A       LDA A   #$0A      .
00277  A335  BD E108             JSR   $E108
00278  A338  86 0D       LDA A   #$0D      .
00279  A33A  BD E108             JSR   $E108
00280                          *
00281                          *           Test if vehicle data is ready to
00282                          *           transfer from shared RAM to block storage
00283                          *
00284  A33D  7D C440 VDRDY  TST   VDATAT    Branch if not ready
00285  A340  27 63          BEQ   VEHOUT
00286                          *
00287                          *           Now format and transfer vehicle data to storage
00288                          *
00289  A342  CE A700        LDX   #BLKSTR   Load and Save starting address of storage block
```

```
TELEM6          MOTOROLA M6RSAM CROSS-ASSEMBLER       PAGE  7

00290 A345 FF A1FE         STX   TEMP2      Load and Save starting address of shared RAM
00291 A348 CE C400         LDX   #AVDATA
00292 A34B FF A1FC         STX   TEMP1
00293               *
00294               *       Start with analog vehicle data
00295               *
00296 A34E A6 00    ALOOP   LDA A 0,X        Load hi byte of analog vehicle data
00297 A350 8A F0            ORA A #$F0       Format hi byte of analog vehicle data
00298 A352 E6 01            LDA B 1,X        Load lo byte of analog vehicle data
00299 A354 08               INX
00300 A355 08               INX
00301 A356 FF A1FC          STX   TEMP1      Save current location in shared RAM
00302 A359 FE A1F6          LDX   VDRTS      Adjust flag
00303 A35C 08               INX
00304 A35D 08               INX
00305 A35E FF A1F6          STX   VDRTS      Save flag
00306 A361 FE A1FE          LDX   TEMP2      Load current location in block storage area
00307 A364 A7 00            STA A 0,X        Save hi byte of analog vehicle data
00308 A366 E7 01            STA B 1,X        Save lo byte of analog vehicle data
00309 A368 08               INX
00310 A369 08               INX
00311 A36A FF A1FE          STX   TEMP2      Save current location in block storage area
00312 A36D FE A1FC          LDX   TEMP1      Load current location in shared RAM
00313 A370 BC C420          CPX   #DVDATA    Test if done with analog vehicle data
00314 A373 26 D9            BNE   ALOOP      Branch back if not
00315               *
00316               *       Now transfer digital vehicle data
00317               *
00318 A375 A6 00    DLOOP   LDA A 0,X        Load hi byte of digital vehicle data
00319 A377 E6 01            LDA B 1,X        Load lo byte of digital vehicle data
00320 A379 08               INX
00321 A37A 08               INX
00322 A37B FF A1FC          STX   TEMP1      Save current location in shared RAM
00323 A37E FE A1F6          LDX   VDRTS      Adjust flag
00324 A381 08               INX
00325 A382 08               INX
00326 A383 FF A1F6          STX   VDRTS      Save flag
00327 A386 FE A1FE          LDX   TEMP2      Load current location in block storage area
00328 A389 A7 00            STA A 0,X        Save hi byte of digital vehicle data
00329 A38B E7 01            STA B 1,X        Save lo byte of digital vehicle data
00330 A38D 08               INX
00331 A38E 08               INX
00332 A38F FF A1FE          STX   TEMP2      Save current location in block storage area
00333 A392 FE A1FC          LDX   TEMP1      Load current location in shared RAM
00334 A395 BC C440          CPX   #VDATAT    Test if done
00335 A398 26 DB            BNE   DLOOP      Branch if not
00336 A39A 6F 00            CLR   0,X        Clear data ready flag (i.e...set data taken)
00337 A39C B6 A1F6          LDA A VDRTS      Test if flag is less than 0
00338 A39F 2B 06            BMI   VEHOUT     Branch if true
```

TELEM6   MOTOROLA M68SAM CROSS-ASSEMBLER   PAGE   8

```
00339 A3A1 CE 0000        LDX    #0        Clear VDRTS flag
00340 A3A4 FF A1F6        STX    VDRTS
00341          *
00342          *     Test if vehicle data is to be sent
00343          *
00344 A3A7 FE A1F6 VEROUT LDX    VDRTS     Check if vehicle data ready to send
00345 A3AA 26 34          BNE    BACK      Branch if not to increment flag
00346 A3AC 7F A1F8        CLR    HBADDR    Set up for vehicle data
00347 A3AF 7F A1F9        CLR    LBADDR
00348          *
00349 A3B2 CE A700        LDX    #BLKSTR   Load with starting address of block
00350 A3B5 A6 00   OLOOP  LDA  A 0,X      Load high byte of data
00351 A3B7 B7 A1FA        STA  A HBDATA   Save in hibyte send register
00352 A3BA A6 01          LDA  A 1,X      Load lo byte of data
00353 A3BC B7 A1FB        STA  A LBDATA   Save in lobyte data send register
00354 A3BF BC A73E        CPX    #BLKSTR+$3E  Test for EOV
00355 A3C2 26 0A          BNE    VSEND     Branch if not
00356 A3C4 86 2E          LDA  A #'.      Put an indication that EOV is being sent....
00357 A3C6 BD E10A        JSR    $E10A     Load EOV signal
00358 A3C9 86 80          LDA  A #$80
00359 A3CB B7 A1FB        STA  A HBADDR
00360 A3CE 8D 1D   VSEND  BSR    SEND      Send data
00361 A3D0 08            INX
00362 A3D1 08            INX
00363 A3D2 7C A1F9       INC    LBADDR    Increment address pointer
00364 A3D5 8C A740       CPX    #BLKSTR+$40  Test if done with data
00365 A3D8 26 DB         BNE    OLOOP     Branch if not
00366          *
00367          *        Load vehicle data ready to send flag.
00368          *
00369 A3DA CE E000       LDX    #$E000
00370 A3DD FF A1F6       STX    VDRTS
00371          *
00372          *        Increment flag register
00373          *
00374 A3E0 FE A1F6 BACK  LDX    VDRTS
00375 A3E3 08            INX
00376 A3E4 FF A1F6       STX    VDRTS
00377          *
00378          *        Clear reset flag
00379          *
00380 A3E7 7F 555F       CLR    $555F     Clear reset flag
00381          *
00382          *        Branch back to top
00383          *
00384 A3EA 7E A242       JMP    TOP       Branch back to top
00385          *
00386          *   Subroutine SEND will put an address from LBADDR
00387          *        and HBADDR, and data from LBDATA and HBDATA on
```

TELEM6   MOTOROLA M68SAM CROSS-ASSEMBLER   PAGE 9

```
                    *                          the ADLC for transmission.
00388               *                          The routine makes use of subroutine OUT.
003B9               *
00391  A3ED B6 A1F9  SEND   LDA  A  LBADDR      Get address, least significant byte
00392  A3F0 8D 17           BSR     OUT
00393  A3F2 B6 A1F8         LDA  A  HBADDR      Get address, most significant byte
00394  A3F5 8D 12           BSR     OUT
00395  A3F7 B6 A1FB         LDA  A  LBDATA      Get data, least significant byte
00396  A3FA 8D 0D           BSR     OUT
00397  A3FC B6 A1FA         LDA  A  HBDATA      Get data, most significant byte
00398  A3FF F6 5550  SENDL  LDA  B  SADLC       Send test byte to ADLC
00399  A402 58              ASL  B              Is transmitter data register ready
00400  A403 2A FA           BPL     SENDL       Branch back if not
00401  A405 B7 5553         STA  A  LDADLC
00402  A408 39              RTS
00403               *
00404               *                          Used by SEND to put address and data information
00405               *                          in the ADLC.
00406               *
00407  A409 F6 5550  OUT    LDA  B  SADLC       Send byte to ADLC
00408  A40C 58              ASL  B              Is transmitter data register available
00409  A40D 2A FA           BPL     OUT         Branch back if not
00410  A40F B7 5552         STA  A  DADLC
00411  A412 39              RTS
00412                       END
```

SYMBOL TABLE

```
START   A200   STACK   A0FF   ADLC    5550   SADLC   5550   DADLC   5552   LDADLC  5553   FIFO    5558
HBLAS.  5558   HBLASD  555A   FIFOT   555C   ELVCNT  A1F2   AZNCNT  A1F3   TOSHOT  A1F4   VBRTS   A1F6
HBADIM  A1FB   LRADDR  A1F9   HBDATA  A1FA   LBDATA  A1FB   TEMP1   A1FB   TEMP2   A1FE   BLKSTR  A700
AVDATA  C400   DVDATA  C420   LWDVDA  C43E   VDATAT  C440   CLOOP   C440   TOP     A242   LASER   A248
WAITLI  A277   NEXT    A27F   NOADVA  A29F   NOADJ   A2A6   VDRDY   A2A6   TOP     A33D   DLOOP   A375
VEHOUT  A3A7   OLOOP   A3B5   VSEND   A3CE   BACK    A3E9   BACK    A3E9   ALOOP   A34E   OUT     A409
                                                           SEND    A3ED   SENDL   A3FF
```

7.2 Tests

7.2.1 <u>Single Step Test Results</u>

Input file: MDL.STEP.00
File Creation Date : WED, JUL 27 1983   System time   13:49:27

**   MODEL1 PARAMETERS   **
HEIGHT FILTER COEFFICIENT   =   0.25
SLOPE FILTER COEFFICIENT   =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0
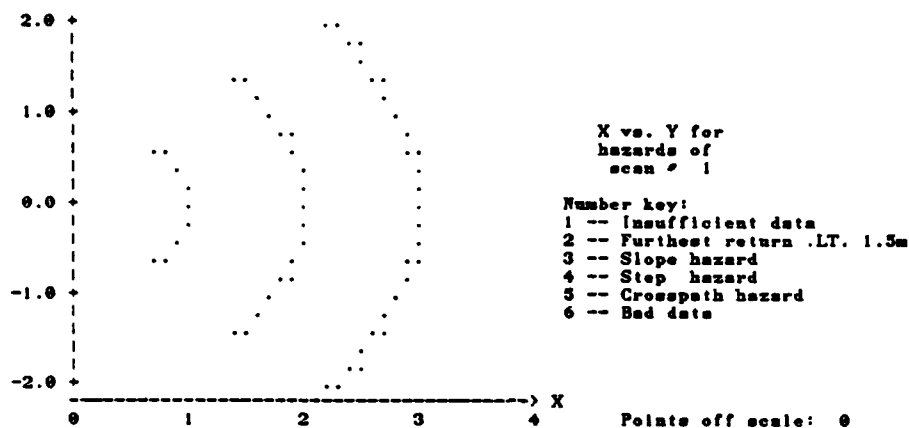
NO HAZARDS CATALOGED THIS SCAN

Input file: MDL.STEP.02
File Creation Date : WED, JUL 27 1983   System time   13:57:36

**   MODEL1 PARAMETERS   **
HEIGHT FILTER COEFFICIENT   =   0.25
SLOPE FILTER COEFFICIENT   =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

NO HAZARDS CATALOGED THIS SCAN

Input file: MDL.STEP.06
File Creation Date : WED, JUL 27 1983   System time   16:06:57

**   MODEL1 PARAMETERS .**
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

NO HAZARDS CATALOGED THIS SCAN

Input file: MDL.STEP.04
File Creation Date : WED, JUL 27 1983   System time   14:00:28

**   MODEL1 PARAMETERS **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

NO HAZARDS CATALOGED THIS SCAN

Input file: MDL.STEP.08
File Creation Date : WED, JUL 27 1983   System time   16:15:17

```
                        **  MODEL1 PARAMETERS  **
              HEIGHT FILTER COEFFICIENT =        0.25
              SLOPE FILTER COEFFICIENT  =        0.90
              LEVEL GROUND STEP THRESHOLD =      0.25 METERS
              SLOPE THRESHOLD =                 30.00 DEGREES
```



```
    2.0 +                        . .
        |                           . .
        |                              .
        |              . .               . .
    1.0 +                   .             .             X vs. Y for
        |                        . .         .          hazards of
        |            . .              .        .          scan #  1
        |              .              .        .
    0.0 +              .              .        .         Number key:
        |              .              .        .         1 -- Insufficient data
        |              .              .        .         2 -- Furthest return .LT. 1.5m
        |            . .              .        .         3 -- Slope hazard
   -1.0 +                   .             .             4 -- Step  hazard
        |              . .              . .              5 -- Crosspath hazard
        |                        . .         .          6 -- Bad data
        |                              .
   -2.0 +                           . .
        ------------------------------------> X
        0       1       2       3       4              Points off scale:  0
```

NO HAZARDS CATALOGED THIS SCAN

Input file: MDL.STEP.10
File Creation Date : WED, JUL 27 1983   System time   16:26:48

```
              **   MODEL1 PARAMETERS   **
        HEIGHT FILTER COEFFICIENT =        0.25
        SLOPE FILTER COEFFICIENT   =        0.90
        LEVEL GROUND STEP THRESHOLD =       0.25 METERS
        SLOPE THRESHOLD =                  30.00 DEGREES
```

```
2.0 +                          ..
    |                              ..
    |                  ..            ..
    |                 ..
    |
1.0 +
    |              .        .
    |             ..             .
    |            .    45   .        ..
    |          .    4              .
0.0 +          .    4              .
    |          .    4              .
    |          .                 .
    |           ..             .
    |              ..        ..
-1.0 +              ..        ..
    |                 ..
    |                  ..        ..
    |                    ..    .
    |                      ..
-2.0 +                      ..
    ------------------------------------> X
    0        1         2         3         4
```

                                              X vs. Y for
                                              hazards of
                                                scan # 1

                                              Number key:
                                              1 -- Insufficient data
                                              2 -- Furthest return .LT. 1.5m
                                              3 -- Slope hazard
                                              4 -- Step hazard
                                              5 -- Crosspath hazard
                                              6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S		C A T A L O G E D	
2	-40.74	N O	H A Z A R D S		C A T A L O G E D	
3	-37.93	N O	H A Z A R D S		C A T A L O G E D	
4	-35.13	N O	H A Z A R D S		C A T A L O G E D	
5	-32.31	N O	H A Z A R D S		C A T A L O G E D	
6	-29.50	N O	H A Z A R D S		C A T A L O G E D	
7	-26.69	N O	H A Z A R D S		C A T A L O G E D	
8	-23.88	N O	H A Z A R D S		C A T A L O G E D	
9	-21.08	N O	H A Z A R D S		C A T A L O G E D	
10	-18.26	N O	H A Z A R D S		C A T A L O G E D	
11	-15.45	N O	H A Z A R D S		C A T A L O G E D	
12	-12.64	N O	H A Z A R D S		C A T A L O G E D	
13	-9.84	1.29	1.27	-0.22	-0.37	Step hazard
14	-7.02	N O	H A Z A R D S		C A T A L O G E D	
15	-4.22	N O	H A Z A R D S		C A T A L O G E D	
16	-1.41	N O	H A Z A R D S		C A T A L O G E D	
17	1.40	1.29	1.29	0.03	-0.37	Step hazard
18	4.21	1.29	1.29	0.09	-0.37	Step hazard
19	7.02	1.29	1.28	0.16	-0.37	Step hazard
20	9.83	N O	H A Z A R D S		C A T A L O G E D	
21	12.64	1.29	1.26	0.28	-0.37	Step hazard
		1.61	1.57	0.35	-0.34	Step hazard
		1.75	1.71	0.38	-0.10	Crosspath hazard
22	15.45	N O	H A Z A R D S		C A T A L O G E D	
23	18.26	N O	H A Z A R D S		C A T A L O G E D	
24	21.07	N O	H A Z A R D S		C A T A L O G E D	
25	23.88	N O	H A Z A R D S		C A T A L O G E D	
26	26.69	N O	H A Z A R D S		C A T A L O G E D	
27	29.50	N O	H A Z A R D S		C A T A L O G E D	
28	32.31	N O	H A Z A R D S		C A T A L O G E D	
29	35.12	N O	H A Z A R D S		C A T A L O G E D	
30	37.93	N O	H A Z A R D S		C A T A L O G E D	
31	40.74	N O	H A Z A R D S		C A T A L O G E D	
32	43.55	N O	H A Z A R D S		C A T A L O G E D	

Input file: MDL.STEP.12
File Creation Date : WED, JUL 27 1983   System time   14:05:35

```
          **  MODEL1 PARAMETERS  **
     HEIGHT FILTER COEFFICIENT =         0.25
     SLOPE FILTER COEFFICIENT  =         0.90
     LEVEL GROUND STEP THRESHOLD =       0.25 METERS
     SLOPE THRESHOLD =                  30.00 DEGREES
```

```
2.0 +                    ..
    |                   ..
    |
1.0 +            ..         .
    |        ..        .      ..
    |      ..    4     4  .      ..
    |          44             .
0.0 +          44       .        .
    |          44       .        .
    |
    |      ..           .      ..
-1.0 +       ..         .      ..
    |
    |           ..         .
-2.0 +              ..
    |------------------------------> X
    0       1       2       3       4
```

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	1.37	1.35	-0.23	-0.34	Step hazard
		1.45	1.43	-0.25	-0.32	Step hazard
14	-7.02	1.33	1.32	-0.16	-0.36	Step hazard
		1.37	1.36	-0.17	-0.35	Step hazard
		1.45	1.44	-0.18	-0.32	Step hazard
15	-4.22	1.29	1.29	-0.09	-0.37	Step hazard
		1.37	1.36	-0.10	-0.36	Step hazard
		1.43	1.44	-0.11	-0.32	Step hazard
16	-1.41	1.33	1.32	-0.03	-0.36	Step hazard
		1.37	1.37	-0.03	-0.35	Step hazard
		1.41	1.41	-0.03	-0.34	Step hazard
17	1.40	1.37	1.37	0.03	-0.34	Step hazard
		1.41	1.41	0.03	-0.33	Step hazard
18	4.21	1.33	1.32	0.10	-0.36	Step hazard
		1.37	1.36	0.10	-0.35	Step hazard
		1.45	1.44	0.11	-0.32	Step hazard
19	7.02	1.29	1.28	0.16	-0.37	Step hazard
		1.37	1.36	0.17	-0.36	Step hazard
		1.45	1.44	0.18	-0.32	Step hazard
20	9.83	1.37	1.35	0.23	-0.34	Step hazard
		1.41	1.39	0.24	-0.33	Step hazard
21	12.64	1.33	1.29	0.29	-0.36	Step hazard
		1.41	1.37	0.31	-0.34	Step hazard
		1.38	1.33	0.41	-0.00	Step hazard
22	15.45	1.41	1.36	0.37	-0.34	Step hazard
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.STEP.14
File Creation Date : WED. JUL 27 1983   System time   14:09:11

```
           **  MODEL1 PARAMETERS  **
     HEIGHT FILTER COEFFICIENT  =         0.25
     SLOPE FILTER COEFFICIENT   =         0.90
     LEVEL GROUND STEP THRESHOLD =        0.25 METERS
     SLOPE THRESHOLD =                   30.00 DEGREES
```

```
2.0 +                         ..
    |                      ..      ..
    |
    |                    ..    ..
    |                         .
1.0 +               ..   ..             .
    |                                        X vs. Y for
    |            .     ..           .        hazards of
    |              44   4 54          .      scan / 1
    |              44      .4
0.0 +            444        .                Number key:
    |             44                  .      1 -- Insufficient data
    |                 4.                     2 -- Furthest return .LT. 1.5m
    |           ..       .              .    3 -- Slope hazard
    |                                        4 -- Step  hazard
-1.0 +            ..     .             .      5 -- Crosspath hazard
    |                .                        6 -- Bad data
    |             ..    .            .
    |                .        .
-2.0 +               ..
    ------------------------------------> X
    0       1       2       3°      4        Points off scale:  0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	1.41	1.39	-0.24	-0.33	Step hazard
		1.41	1.39	-0.24	-0.33	Step hazard
		1.52	1.50	-0.26	-0.35	Step hazard
		1.96	1.93	-0.33	0.00	Step hazard
14	-7.02	1.37	1.36	-0.17	-0.34	Step hazard
		1.41	1.40	-0.17	-0.33	Step hazard
		1.41	1.40	-0.17	-0.33	Step hazard
15	-4.22	1.33	1.32	-0.10	-0.36	Step hazard
		1.41	1.40	-0.10	-0.34	Step hazard
		1.41	1.40	-0.10	-0.34	Step hazard
16	-1.41	1.33	1.32	-0.03	-0.36	Step hazard
		1.41	1.41	-0.03	-0.34	Step hazard
17	1.40	1.33	1.32	0.03	-0.36	Step hazard
		1.41	1.41	0.03	-0.34	Step hazard
		1.41	1.41	0.03	-0.34	Step hazard
		1.48	1.48	0.04	-0.29	Step hazard
18	4.21	1.37	1.36	0.10	-0.34	Step hazard
		1.41	1.40	0.10	-0.33	Step hazard
		1.41	1.40	0.10	-0.33	Step hazard
19	7.02	1.41	1.40	0.17	-0.34	Step hazard
		1.52	1.51	0.19	-0.35	Step hazard
		1.52	1.51	0.19	-0.35	Step hazard
		2.10	2.09	0.26	-0.01	Step hazard
20	9.83	1.41	1.39	0.24	-0.34	Step hazard
		1.41	1.39	0.24	-0.34	Step hazard
		1.52	1.50	0.26	-0.35	Step hazard
		1.52	1.50	0.26	-0.35	Step hazard
		2.10	2.07	0.36	-0.01	Step hazard
21	12.64	1.41	1.37	0.31	-0.34	Step hazard
		1.41	1.37	0.31	-0.34	Step hazard
		1.52	1.49	0.33	-0.35	Step hazard
		1.52	1.49	0.33	-0.35	Step hazard
		1.88	1.83	0.41	0.01	Step hazard
		2.00	1.95	0.44	0.01	Crosspath hazard
22	15.45	1.41	1.36	0.37	-0.34	Step hazard
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.STEP.16
File Creation Date : WED, JUL 27 1983   System time   16:37:42

** MODEL1 PARAMETERS **
```
HEIGHT FILTER COEFFICIENT =          0.25
SLOPE FILTER COEFFICIENT =           0.90
LEVEL GROUND STEP THRESHOLD =        0.25 METERS
SLOPE THRESHOLD =                    30.00 DEGREES
```

```
 2.0 +
     |                          . .
     |                      .       . .
     |                    .           .
     |
 1.0 +                  .               .
     |                .                   .
     |               .                     .
     |              .      44 445 .4        .
     |                     444    44
 0.0 +             .       44      .4        .
     |                     4444    44
     |              .                       .
     |               .                     .
     |                .                   .
-1.0 +                  .               .
     |                    .           .
     |                      .       . .
     |                          . .
-2.0 +                      . .
     |
     --------------------------------------> X
     0        1         2         3         4
```

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	1.33	1.31	-0.23	-0.38	Step hazard
		1.37	1.35	-0.23	-0.36	Step hazard
		1.60	1.57	-0.27	-0.00	Step hazard
14	-7.02	1.37	1.36	-0.17	-0.36	Step hazard
		1.49	1.48	-0.18	-0.35	Step hazard
		2.06	2.05	-0.23	0.03	Step hazard
15	-4.22	1.29	1.29	-0.09	-0.37	Step hazard
		1.37	1.36	-0.10	-0.36	Step hazard
		2.06	2.06	-0.13	0.03	Step hazard
16	-1.41	1.33	1.32	-0.03	-0.38	Step hazard
		1.37	1.37	-0.03	-0.36	Step hazard
		1.41	1.41	-0.03	-0.34	Step hazard
		2.06	2.06	-0.03	0.03	Step hazard
17	1.40	1.29	1.29	0.03	-0.37	Step hazard
		1.37	1.37	0.03	-0.36	Step hazard
		1.41	1.41	0.03	-0.34	Step hazard
		2.06	2.06	0.03	0.03	Step hazard
18	4.21	1.29	1.29	0.09	-0.37	Step hazard
		1.37	1.36	0.10	-0.36	Step hazard
		2.06	2.06	0.15	0.03	Step hazard
19	7.02	1.29	1.28	0.16	-0.37	Step hazard
		1.37	1.36	0.17	-0.36	Step hazard
		2.06	2.05	0.23	0.03	Step hazard
20	9.83	1.37	1.35	0.23	-0.36	Step hazard
		1.41	1.39	0.24	-0.34	Step hazard
		1.49	1.47	0.25	-0.38	Step hazard
		2.13	2.10	0.36	0.03	Step hazard
21	12.64	1.37	1.33	0.30	-0.37	Step hazard
		1.49	1.45	0.33	-0.38	Step hazard
22	15.45	1.29	1.24	0.34	-0.37	Step hazard
		1.37	1.32	0.36	-0.36	Step hazard
		1.61	1.55	0.43	0.05	Step hazard
		1.75	1.69	0.47	0.05	Crosspath hazard
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.STEP.1B
File Creation Date : WED, JUL 27 1983   System time   18:48:42

```
          ==  MODEL1 PARAMETERS  ==
      HEIGHT FILTER COEFFICIENT  :          0.25
      SLOPE FILTER COEFFICIENT   :          0.90
      LEVEL GROUND STEP THRESHOLD :         0.25 METERS
      SLOPE THRESHOLD  :                   30.00 DEGREES
```


X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

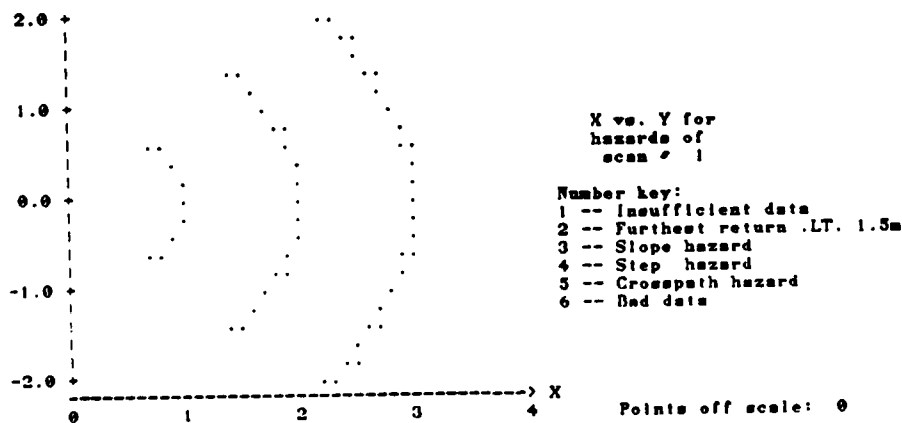| AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.43	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	1.29	1.27	-0.22	-0.37	Step hazard
		1.29	1.27	-0.22	-0.37	Step hazard
		1.29	1.27	-0.22	-0.37	Step hazard
		1.33	1.31	-0.23	-0.37	Step hazard
		1.37	1.33	-0.23	-0.29	Step hazard
		1.61	1.59	-0.28	0.08	Step hazard
14	-7.02	1.29	1.28	-0.16	-0.37	Step hazard
		1.29	1.28	-0.16	-0.37	Step hazard
		1.29	1.28	-0.16	-0.37	Step hazard
		1.33	1.32	-0.16	-0.37	Step hazard
		1.37	1.36	-0.17	-0.29	Step hazard
15	-4.22	1.33	1.32	-0.10	-0.38	Step hazard
		1.40	1.40	-0.10	-0.25	Step hazard
16	-1.41	1.29	1.29	-0.03	-0.37	Step hazard
		1.29	1.29	-0.03	-0.37	Step hazard
		1.29	1.29	-0.03	-0.37	Step hazard
		1.33	1.32	-0.03	-0.37	Step hazard
		1.37	1.36	-0.03	-0.29	Step hazard
17	1.40	1.29	1.29	0.03	-0.37	Step hazard
		1.29	1.29	0.03	-0.37	Step hazard
		1.33	1.32	0.03	-0.37	Step hazard
		1.37	1.36	0.03	-0.29	Step hazard
		2.00	2.00	0.05	0.09	Step hazard
18	4.21	1.33	1.32	0.10	-0.38	Step hazard
		1.33	1.32	0.10	-0.38	Step hazard
		1.33	1.32	0.10	-0.38	Step hazard
		1.37	1.36	0.10	-0.36	Step hazard
19	7.02	1.33	1.32	0.16	-0.38	Step hazard
		1.37	1.36	0.17	-0.29	Step hazard
		1.37	1.36	0.17	-0.29	Step hazard
		1.40	1.39	0.17	-0.11	Step hazard
20	9.83	1.29	1.27	0.22	-0.37	Step hazard
		1.29	1.27	0.22	-0.37	Step hazard
		1.29	1.27	0.22	-0.37	Step hazard
		1.33	1.31	0.23	-0.37	Step hazard
		1.37	1.35	0.23	-0.29	Step hazard
21	12.64	1.29	1.26	0.28	-0.37	Step hazard
		1.29	1.26	0.28	-0.37	Step hazard
		1.33	1.29	0.29	-0.37	Step hazard
		1.37	1.33	0.30	-0.29	Step hazard
22	15.45	1.29	1.24	0.34	-0.37	Step hazard
		1.29	1.24	0.34	-0.37	Step hazard
		1.33	1.28	0.35	-0.37	Step hazard
		1.41	1.36	0.37	-0.34	Step hazard
		1.50	1.45	0.40	0.06	Crosspath hazard
		1.61	1.55	0.43	0.08	Step hazard
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.30	N O	H A Z A R D S	C A T A L O G E D		
28	32.11	N O	H A Z A R D S	C A T A L O G E D		
29	33.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

== MODEL: PARAMETERS ==
HEIGHT FILTER COEFFICIENT = 0.25
SLOPE FILTER COEFFICIENT = 0.90
LEVEL GROUND STEP THRESHOLD = 0.25 METERS
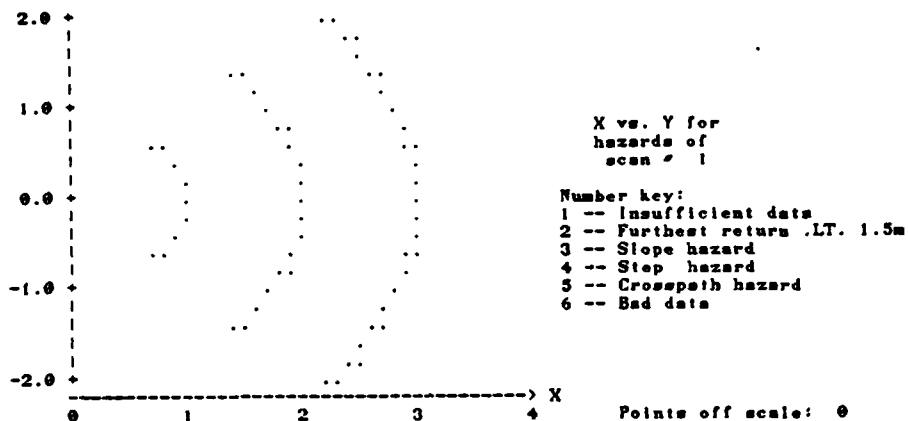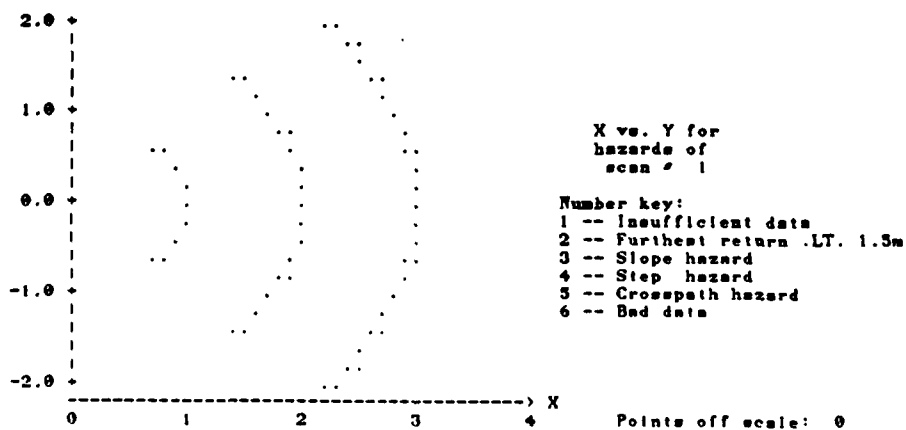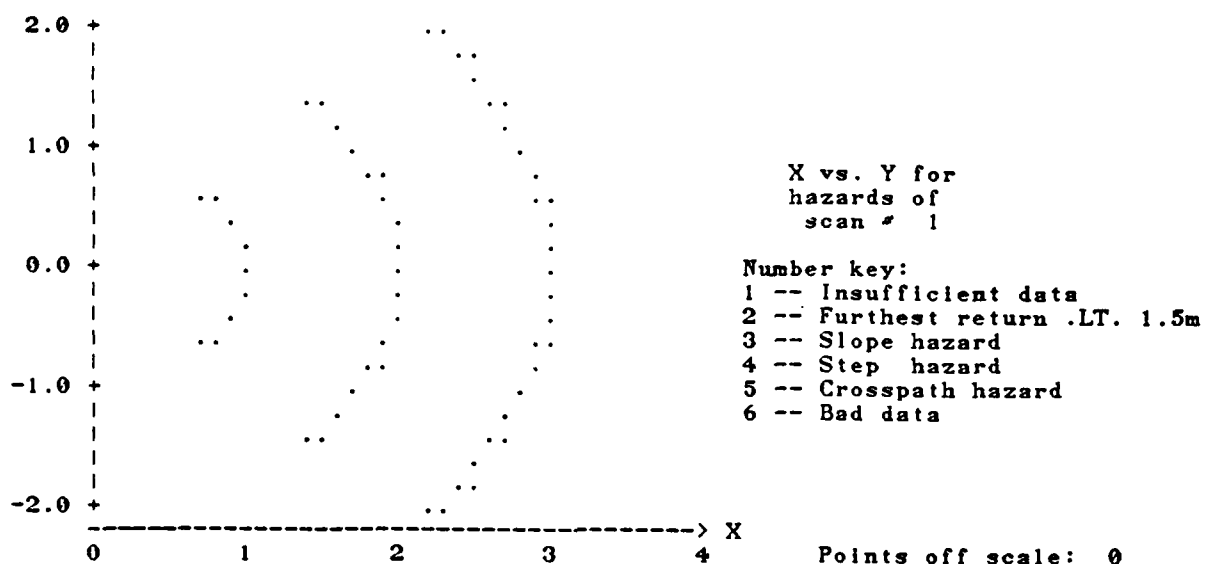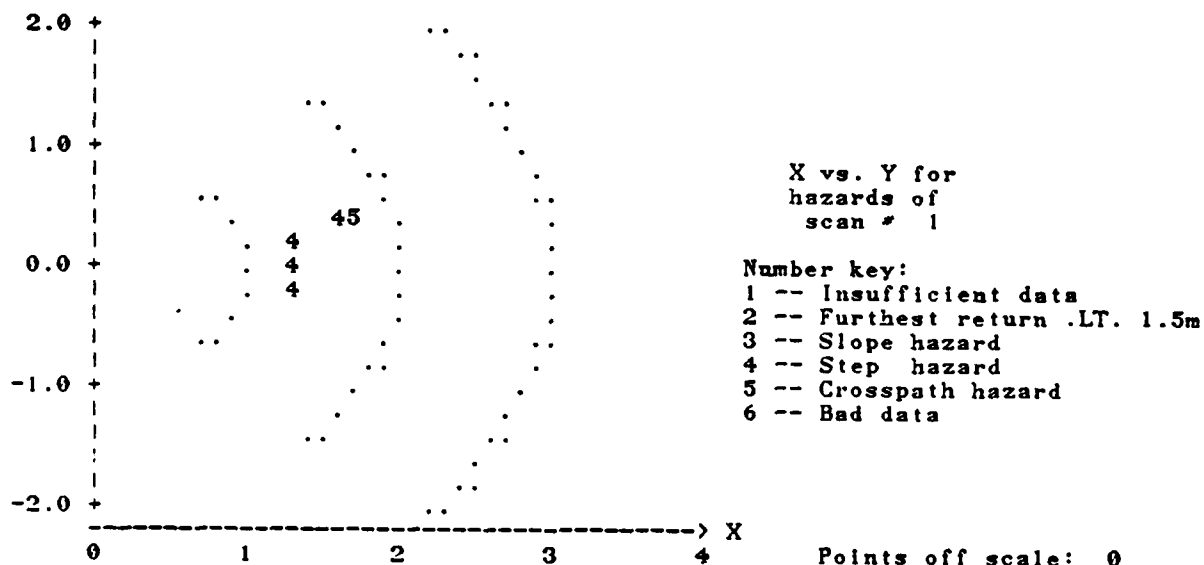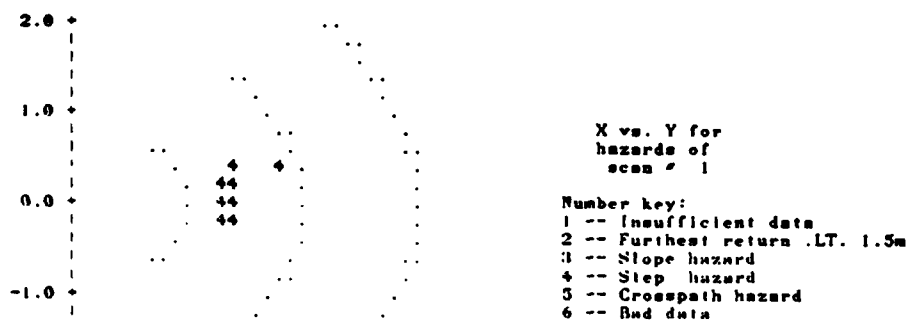SLOPE THRESHOLD = 30.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Farthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56		NO HAZARDS			CATALOGED
2	-40.74		NO HAZARDS			CATALOGED
3	-37.93		NO HAZARDS			CATALOGED
4	-35.13		NO HAZARDS			CATALOGED
5	-32.31		NO HAZARDS			CATALOGED
6	-29.50		NO HAZARDS			CATALOGED
7	-26.69		NO HAZARDS			CATALOGED
8	-23.88		NO HAZARDS			CATALOGED
9	-21.08		NO HAZARDS			CATALOGED
10	-18.26		NO HAZARDS			CATALOGED
11	-15.43		NO HAZARDS			CATALOGED
12	-12.64	1.33	1.29	-0.29	-0.36	Step hazard
		1.33	1.29	-0.29	-0.36	Step hazard
		1.37	1.33	-0.30	-0.35	Step hazard
		1.45	1.41	-0.32	-0.32	Step hazard
		1.45	1.41	-0.32	-0.32	Step hazard
		1.69	1.65	-0.37	0.16	Step hazard
13	-9.84	1.33	1.31	-0.23	-0.36	Step hazard
		1.35	1.31	-0.23	-0.36	Step hazard
		1.37	1.35	-0.23	-0.35	Step hazard
		1.43	1.41	-0.24	-0.23	Step hazard
		1.49	1.47	-0.25	-0.34	Step hazard
14	-7.02	1.24	1.24	-0.15	-0.30	Step hazard
		1.33	1.32	-0.16	-0.36	Step hazard
		1.35	1.32	-0.16	-0.36	Step hazard
		1.37	1.36	-0.17	-0.35	Step hazard
		1.43	1.42	-0.18	-0.24	Step hazard
		1.49	1.48	-0.18	-0.28	Step hazard
15	-4.22	1.24	1.24	-0.09	-0.30	Step hazard
		1.28	1.28	-0.09	-0.29	Step hazard
		1.46	1.46	-0.11	0.06	Step hazard
		2.00	1.99	-0.15	0.16	Step hazard
16	-1.41	1.24	1.24	-0.03	-0.30	Step hazard
		1.33	1.32	-0.03	-0.36	Step hazard
		1.37	1.37	-0.03	-0.35	Step hazard
		1.43	1.43	-0.04	-0.21	Step hazard
		1.46	1.46	-0.04	0.06	Step hazard
		2.00	2.00	-0.03	0.16	Step hazard
17	1.40	1.33	1.32	0.03	-0.36	Step hazard
		1.33	1.32	0.03	-0.36	Step hazard
		1.37	1.37	0.03	-0.35	Step hazard
		1.43	1.43	0.04	-0.32	Step hazard
		2.00	2.00	0.05	0.16	Step hazard
18	4.21	1.24	1.24	0.09	-0.30	Step hazard
		1.33	1.32	0.10	-0.36	Step hazard
		1.37	1.36	0.10	-0.35	Step hazard
		1.43	1.43	0.11	-0.21	Step hazard
		1.46	1.46	0.11	0.06	Step hazard
		2.00	1.99	0.15	0.16	Step hazard
19	7.02	1.24	1.24	0.15	-0.30	Step hazard
		1.28	1.27	0.16	-0.29	Step hazard
		1.37	1.36	0.17	-0.34	Step hazard
		1.43	1.42	0.18	-0.21	Step hazard
		1.46	1.45	0.18	0.06	Step hazard
		2.00	1.98	0.24	0.16	Step hazard
20	9.83	1.24	1.23	0.21	-0.30	Step hazard
		1.33	1.31	0.23	-0.36	Step hazard
		1.37	1.35	0.23	-0.35	Step hazard
		1.43	1.41	0.24	-0.21	Step hazard
		1.46	1.44	0.25	0.06	Step hazard
		1.50	1.48	0.26	0.06	Crosspath hazard
		2.00	1.97	0.34	0.16	Step hazard
21	12.64	1.33	1.29	0.29	-0.37	Step hazard
		1.37	1.33	0.30	-0.36	Step hazard
		1.43	1.40	0.31	-0.24	Step hazard
		1.49	1.45	0.33	-0.34	Step hazard
		1.75	1.71	0.38	0.13	Crosspath hazard
		1.95	1.90	0.43	0.14	Step hazard
22	15.45		NO HAZARDS			CATALOGED
23	18.26		NO HAZARDS			CATALOGED
24	21.07		NO HAZARDS			CATALOGED
25	23.88		NO HAZARDS			CATALOGED
26	26.69		NO HAZARDS			CATALOGED
27	29.50		NO HAZARDS			CATALOGED
28	32.31		NO HAZARDS			CATALOGED
29	35.12		NO HAZARDS			CATALOGED
30	37.93		NO HAZARDS			CATALOGED
31	40.74		NO HAZARDS			CATALOGED
32	43.55		NO HAZARDS			CATALOGED

7.2.2 Slope Test Results

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[1]Slope Coefficient
[2]Slope Threshold in degrees

7.2.2.1 B=0.90; Slope Threshold=30

Input file: MDL.SLOPE.05.30.90
File Creation Date : THU, AUG 11 1983   System time   19:11:26

MODEL1 PARAMETERS
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0
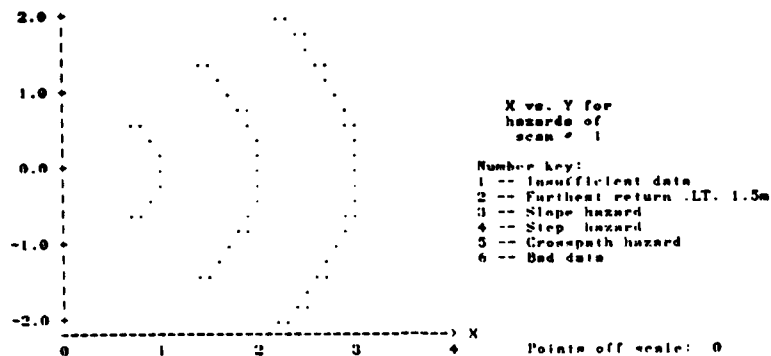
NO HAZARDS CATALOGED THIS SCAN

Input file: MDL.SLOPE.10.30.90
File Creation Date : THU, AUG 11 1983   System time   19:17:01

MODEL1 PARAMETERS
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

NO HAZARDS CATALOGED THIS SCAN

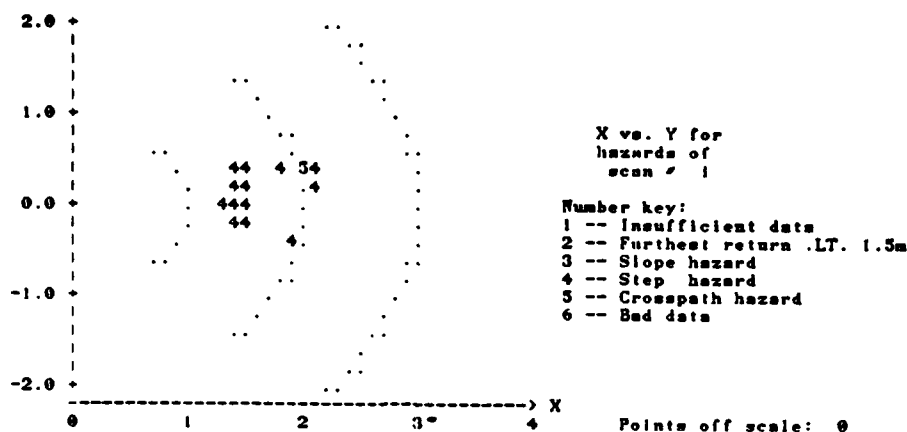Input file: MDL.SLOPE.15.30.90
File Creation Date : THU. AUG 11 1983   System time   19:23:55

**   MODEL1 PARAMETERS   **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S		C A T A L O G E D	
2	-40.74	N O	H A Z A R D S		C A T A L O G E D	
3	-37.93	N O	H A Z A R D S		C A T A L O G E D	
4	-35.13	N O	H A Z A R D S		C A T A L O G E D	
5	-32.31	N O	H A Z A R D S		C A T A L O G E D	
6	-29.50	N O	H A Z A R D S		C A T A L O G E D	
7	-26.69	N O	H A Z A R D S		C A T A L O G E D	
8	-23.88	N O	H A Z A R D S		C A T A L O G E D	
9	-21.08	N O	H A Z A R D S		C A T A L O G E D	
10	-18.26	N O	H A Z A R D S		C A T A L O G E D	
11	-15.45	N O	H A Z A R D S		C A T A L O G E D	
12	-12.64	N O	H A Z A R D S		C A T A L O G E D	
13	-9.84	N O	H A Z A R D S		C A T A L O G E D	
14	-7.02	N O	H A Z A R D S		C A T A L O G E D	
15	-4.22	N O	H A Z A R D S		C A T A L O G E D	
16	-1.41	N O	H A Z A R D S		C A T A L O G E D	
17	1.40	N O	H A Z A R D S		C A T A L O G E D	
18	4.21	N O	H A Z A R D S		C A T A L O G E D	
19	7.02	N O	H A Z A R D S		C A T A L O G E D	
20	9.83	N O	H A Z A R D S		C A T A L O G E D	
21	12.64	2.25	2.20	0.49	-0.04	Crosspath hazard
22	15.45	N O	H A Z A R D S		C A T A L O G E D	
23	18.26	N O	H A Z A R D S		C A T A L O G E D	
24	21.07	N O	H A Z A R D S		C A T A L O G E D	
25	23.88	N O	H A Z A R D S		C A T A L O G E D	
26	26.69	N O	H A Z A R D S		C A T A L O G E D	
27	29.50	N O	H A Z A R D S		C A T A L O G E D	
28	32.31	N O	H A Z A R D S		C A T A L O G E D	
29	35.12	N O	H A Z A R D S		C A T A L O G E D	
30	37.93	N O	H A Z A R D S		C A T A L O G E D	
31	40.74	N O	H A Z A R D S		C A T A L O G E D	
32	43.55	N O	H A Z A R D S		C A T A L O G E D	

Input file: MDL.SLOPE.20.30.90
File Creation Date : THU, AUG 11 1983   System time   19:26:15

```
                        **    MODEL1 PARAMETERS    **
            HEIGHT FILTER COEFFICIENT =            0.25
            SLOPE FILTER COEFFICIENT  =            0.90
            LEVEL GROUND STEP THRESHOLD =          0.25 METERS
            SLOPE THRESHOLD =                      30.00 DEGREES
```



```
X vs. Y for
hazards of
  scan #  1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step  hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale:   0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S		C A T A L O G E D	
2	-40.74	N O	H A Z A R D S		C A T A L O G E D	
3	-37.93	N O	H A Z A R D S		C A T A L O G E D	
4	-35.13	N O	H A Z A R D S		C A T A L O G E D	
5	-32.31	N O	H A Z A R D S		C A T A L O G E D	
6	-29.50	N O	H A Z A R D S		C A T A L O G E D	
7	-26.69	N O	H A Z A R D S		C A T A L O G E D	
8	-23.88	N O	H A Z A R D S		C A T A L O G E D	
9	-21.08	N O	H A Z A R D S		C A T A L O G E D	
10	-18.26	N O	H A Z A R D S		C A T A L O G E D	
11	-15.45	N O	H A Z A R D S		C A T A L O G E D	
12	-12.64	N O	H A Z A R D S		C A T A L O G E D	
13	-9.84	N O	H A Z A R D S		C A T A L O G E D	
14	-7.02	N O	H A Z A R D S		C A T A L O G E D	
15	-4.22	N O	H A Z A R D S		C A T A L O G E D	
16	-1.41	N O	H A Z A R D S		C A T A L O G E D	
17	1.40	N O	H A Z A R D S		C A T A L O G E D	
18	4.21	N O	H A Z A R D S		C A T A L O G E D	
19	7.02	N O	H A Z A R D S		C A T A L O G E D	
20	9.83	N O	H A Z A R D S		C A T A L O G E D	
21	12.64	2.04	1.99	0.45	-0.01	Step hazard
		2.25	2.20	0.49	-0.01	Crosspath hazard
22	15.45	N O	H A Z A R D S		C A T A L O G E D	
23	18.26	N O	H A Z A R D S		C A T A L O G E D	
24	21.07	N O	H A Z A R D S		C A T A L O G E D	
25	23.88	N O	H A Z A R D S		C A T A L O G E D	
26	26.69	N O	H A Z A R D S		C A T A L O G E D	
27	29.50	N O	H A Z A R D S		C A T A L O G E D	
28	32.31	N O	H A Z A R D S		C A T A L O G E D	
29	35.12	N O	H A Z A R D S		C A T A L O G E D	
30	37.93	N O	H A Z A R D S		C A T A L O G E D	
31	40.74	N O	H A Z A R D S		C A T A L O G E D	
32	43.55	N O	H A Z A R D S		C A T A L O G E D	

Input file: MDL.SLOPE.25.30.90
File Creation Date : THU, AUG 11 1983   System time   19:28:08

**   ** MODEL1 PARAMETERS   **
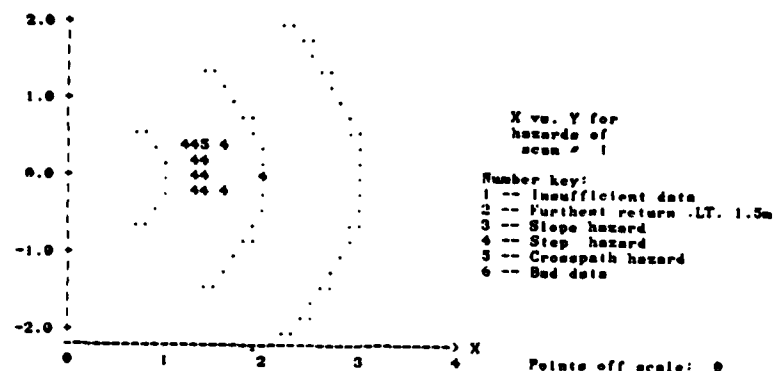HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

```
 2.0 +                          . .
     |                            . .
     |                               .
     |                            .
     |                 . .              . .
     |              .                      .
 1.0 +              .                    .
     |                                           X vs. Y for
     |         . .        . .            . .     hazards of
     |       .         4   .          .             scan #  1
     |                                           
 0.0 +       .              .          .         Number key:
     |                                           1 -- Insufficient data
     |       .              .          .         2 -- Furthest return .LT. 1.5m
     |                                           3 -- Slope hazard
     |         . .        . .          . .       4 -- Step  hazard
-1.0 +         .              .                  5 -- Crosspath hazard
     |              .                    .       6 -- Bad data
     |                 . .              . .
     |                    .
     |                       . .
-2.0 +                    . .
     ----------------------------------------> X
     0         1         2         3         4        Points off scale:  0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	N O	H A Z A R D S	C A T A L O G E D		
16	-1.41	N O	H A Z A R D S	C A T A L O G E D		
17	1.40	N O	H A Z A R D S	C A T A L O G E D		
19	7.02	N O	H A Z A R D S	C A T A L O G E D		
20	9.83	N O	H A Z A R D S	C A T A L O G E D		
21	12.64	N O	H A Z A R D S	C A T A L O G E D		
22	15.45	1.72	1.66	0.46	-0.01	Step hazard
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.SLOPE.30.30.90
File Creation Date : THU, AUG 11 1983   System time   19:29:12

MODEL1 PARAMETERS

HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT   =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S		C A T A L O G E D	
2	-40.74	N O	H A Z A R D S		C A T A L O G E D	
3	-37.93	N O	H A Z A R D S		C A T A L O G E D	
4	-35.13	N O	H A Z A R D S		C A T A L O G E D	
5	-32.31	N O	H A Z A R D S		C A T A L O G E D	
6	-29.50	N O	H A Z A R D S		C A T A L O G E D	
7	-26.69	N O	H A Z A R D S		C A T A L O G E D	
8	-23.88	N O	H A Z A R D S		C A T A L O G E D	
9	-21.08	N O	H A Z A R D S		C A T A L O G E D	
10	-18.26	N O	H A Z A R D S		C A T A L O G E D	
11	-15.45	N O	H A Z A R D S		C A T A L O G E D	
12	-12.64	N O	H A Z A R D S		C A T A L O G E D	
13	-9.84	1.84	1.81	-0.31	0.19	Step hazard
14	-7.02	N O	H A Z A R D S		C A T A L O G E D	
15	-4.22	N O	H A Z A R D S		C A T A L O G E D	
16	-1.41	N O	H A Z A R D S		C A T A L O G E D	
17	1.40	1.55	1.55	0.04	-0.00	Step hazard
18	4.21	1.55	1.55	0.11	-0.00	Step hazard
19	7.02	N O	H A Z A R D S		C A T A L O G E D	
20	9.83	N O	H A Z A R D S		C A T A L O G E D	
21	12.64	N O	H A Z A R D S		C A T A L O G E D	
22	15.45	1.82	1.76	0.49	0.15	Step hazard
23	18.26	1.55	1.47	0.49	-0.01	Step hazard
		1.75	1.66	0.55	-0.01	Crosspath hazard
24	21.07	N O	H A Z A R D S		C A T A L O G E D	
25	23.88	N O	H A Z A R D S		C A T A L O G E D	
26	26.69	N O	H A Z A R D S		C A T A L O G E D	
27	29.50	N O	H A Z A R D S		C A T A L O G E D	
28	32.31	N O	H A Z A R D S		C A T A L O G E D	
29	35.12	N O	H A Z A R D S		C A T A L O G E D	
30	37.93	N O	H A Z A R D S		C A T A L O G E D	
31	40.74	N O	H A Z A R D S		C A T A L O G E D	
32	43.55	N O	H A Z A R D S		C A T A L O G E D	

Input file: MDL.SLOPE.35.30.90
File Creation Date : THU, AUG 11 1983   System time   19:31:35

**   MODEL1 PARAMETERS   **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT   =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

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2.0 +
    |                              . .
    |                                .
    |                          .        .
    |                       .              .
1.0 +                                          .
    |                      .                      .
    |            . .      4 5 .                 . .          X vs. Y for
    |                 .      44      .                       hazards of
    |                         4       .                        scan # 1
0.0 +                 .       4        .
    |                         4         .                    Number key:
    |                 .          4    .                      1 -- Insufficient data
    |                                .                       2 -- Furthest return .LT. 1.5m
    |            . .               .                         3 -- Slope hazard
    |                      . .       .                       4 -- Step  hazard
-1.0 +                 .              .                      5 -- Crosspath hazard
    |                        .                               6 -- Bad data
    |            . .       .
    |                    .
    |                 . .
-2.0 +            . .
    ---------------------------------------------> X
    0          1          2          3          4        Points off scale:  0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	1.82	1.79	-0.31	0.27	Step hazard
14	-7.02	1.51	1.50	-0.19	0.07	Step hazard
15	-4.22	N O	H A Z A R D S	C A T A L O G E D		
16	-1.41	1.51	1.51	-0.04	0.06	Step hazard
17	1.40	1.51	1.51	0.04	0.07	Step hazard
18	4.21	1.63	1.62	0.12	0.23	Step hazard
19	7.02	N O	H A Z A R D S	C A T A L O G E D		
20	9.83	1.51	1.49	0.26	0.07	Step hazard
21	12.64	N O	H A Z A R D S	C A T A L O G E D		
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	1.61	1.53	0.50	0.07	Step hazard
		1.75	1.66	0.55	0.07	Crosspath hazard
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.SLOPE.40.30.90
File Creation Date : THU, AUG 11 1983   System time   19:33:39

```
                    **  MODEL1 PARAMETERS  **
          HEIGHT FILTER COEFFICIENT =        0.25
          SLOPE FILTER COEFFICIENT  =        0.90
          LEVEL GROUND STEP THRESHOLD =      0.25 METERS
          SLOPE THRESHOLD =                  30.00 DEGREES
```

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 2.0 +                              ..
     I                                .
     I                                 ..
     I
     I
 1.0 +
     I                    ..              .
     I              .                 .
     I           ..         4
     I        ..        444        .            ..
 0.0 +        .         44     .                 .
     I           .      4    .                   .
     I              .             .
     I              ..           .              ..
     I
-1.0 +                      ..             .
     I                 ..                 .
     I                    ..            .
     I
     I
-2.0 +                       ..
     I ------------------------------------------> X
         0        1        2        3        4
```

X vs. Y for
hazards of
 scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T	A L O C E D	
2	-40.74	N O	H A Z A R D S	C A T	A L O G E D	
3	-37.93	N O	H A Z A R D S	C A T	A L O C E D	
4	-35.13	H A Z A R D S	C A T	A L O C E D		
5	-32.31	N O	H A Z A R D S	C A T	A L O G E D	
6	-29.50	N O	H A Z A R D S	C A T	A L O G E D	
7	-26.69	N O	H A Z A R D S	C A T	A L O G E D	
8	-23.88	N O	H A Z A R D S	C A T	A L O G E D	
9	-21.08	N O	H A Z A R D S	C A T	A L O C E D	
10	-18.26	N O	H A Z A R D S	C A T	A L O C E D	
11	-15.45	N O	H A Z A R D S	C A T	A L O C E D	
12	-12.64	1.34	1.31	-0.29	0.07	Step hazard
13	-9.84	N O	H A Z A R D S	C A T	A L O C E D	
14	-7.02	N O	H A Z A R D S	C A T	A L O C E D	
15	-4.22	N O	H A Z A R D S	C A T	A L O C E D	
16	-1.41	N O	H A Z A R D S	C A T	A L O C E D	
17	1.40	1.42	1.42	0.03	0.13	Step hazard
		1.51	1.51	0.04	0.16	Step hazard
18	4.21	1.42	1.42	0.10	0.13	Step hazard
		1.51	1.51	0.11	0.16	Step hazard
19	7.02	1.59	1.57	0.19	0.28	Step hazard
20	9.83	N O	H A Z A R D S	C A T	A L O C E D	
21	12.64	N O	H A Z A R D S	C A T	A L O C E D	
22	15.45	N O	H A Z A R D S	C A T	A L O C E D	
23	18.26	1.60	1.51	0.50	0.23	Step hazard
24	21.07	N O	H A Z A R D S	C A T	A L O C E D	
25	23.88	N O	H A Z A R D S	C A T	A L O C E D	
26	26.69	N O	H A Z A R D S	C A T	A L O C E D	
27	29.50	N O	H A Z A R D S	C A T	A L O C E D	
28	32.31	N O	H A Z A R D S	C A T	A L O C E D	
29	35.12	N O	H A Z A R D S	C A T	A L O C E D	
30	37.93	N O	H A Z A R D S	C A T	A L O C E D	
31	40.74	N O	H A Z A R D S	C A T	A L O C E D	
32	43.35	N O	H A Z A R D S	C A T	A L O C E D	

7.2.2.2 <u>B=0.85;</u> <u>Slope</u> <u>Threshold=30</u>

117

Input file: MDL.SLOPE.05.30.83
File Creation Date : THU. AUG 11 1983   System time   19:39:15
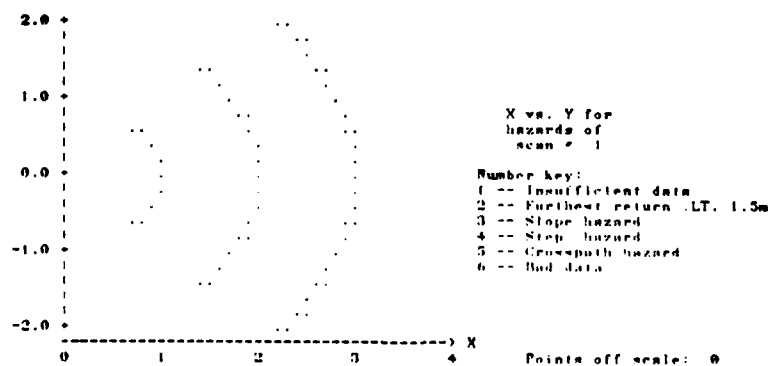
** MODEL1 PARAMETERS **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.85
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES
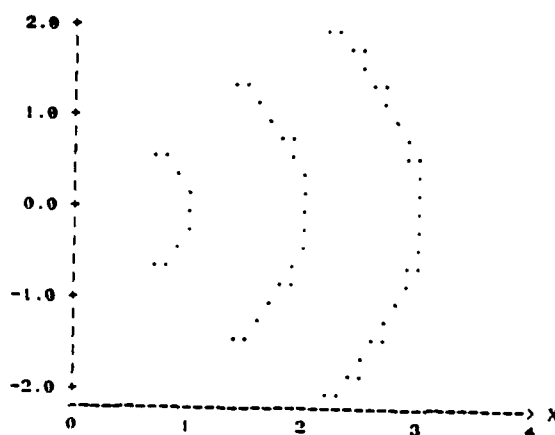
X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

NO HAZARDS CATALOGED THIS SCAN
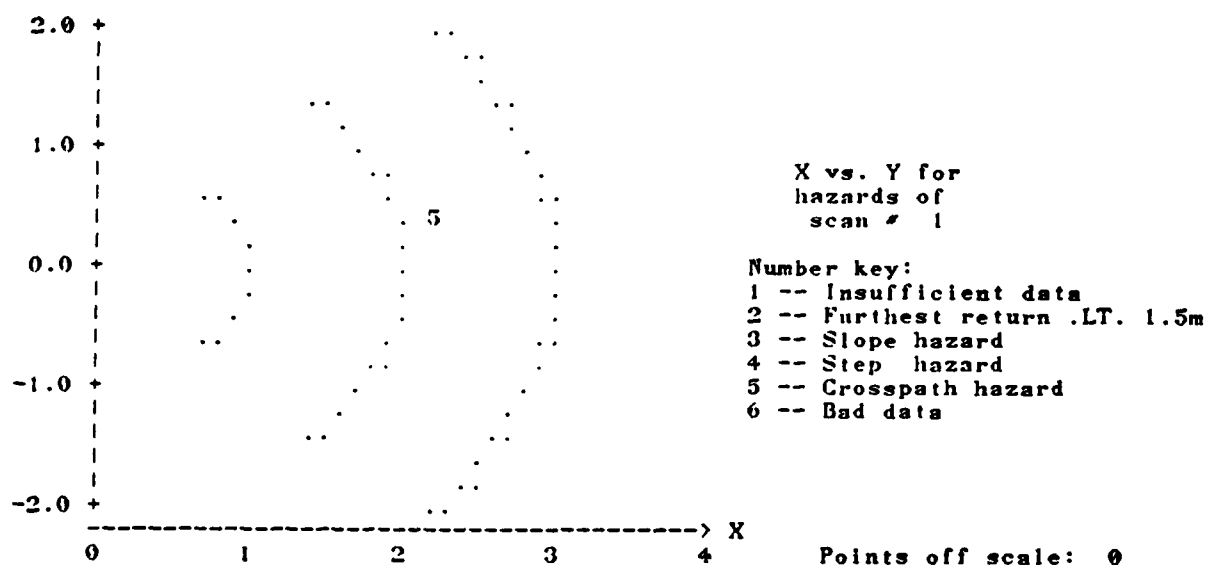

Input file: MDL.SLOPE.10.30.83
File Creation Date : THU. AUG 11 1983   System time   19:39:49

** MODEL1 PARAMETERS **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.85
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES
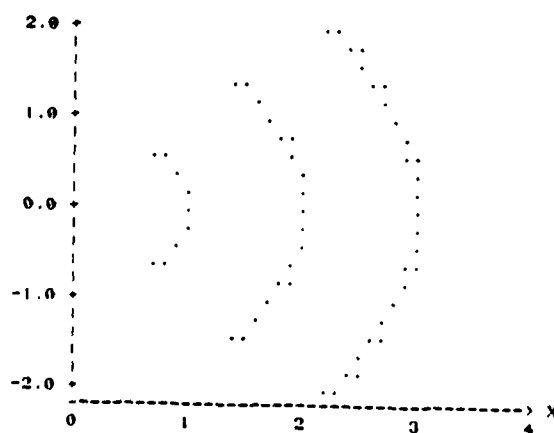
X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

NO HAZARDS CATALOGED THIS SCAN

Input file: MDL.SLOPE.15.30.85
File Creation Date : THU, AUG 11 1983   System time   19:40:30

**   ** MODEL1 PARAMETERS **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.85
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES


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 2.0 +                            ..
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     |                        ..          .
 1.0 +                                      .
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     |                  ..          5            .
 0.0 +                   .                       .
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     |                 .                        .
     |                ..                       .
     |                  ..                   .
-1.0 +                  .                   .
     |                    ..              .
     |                      ..          ..
     |                        ..
-2.0 +                          ..
     +----------------------------------------> X
     0         1         2         3         4
```

X vs. Y for
hazards of
    scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	N O	H A Z A R D S	C A T A L O G E D		
16	-1.41	N O	H A Z A R D S	C A T A L O G E D		
17	1.40	N O	H A Z A R D S	C A T A L O G E D		
18	4.21	N O	H A Z A R D S	C A T A L O G E D		
19	7.02	N O	H A Z A R D S	C A T A L O G E D		
20	9.83	N O	H A Z A R D S	C A T A L O G E D		
21	12.64	2.25	2.20	0.49	-0.04	Crosspath hazard
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.SLOPE.20.30.85
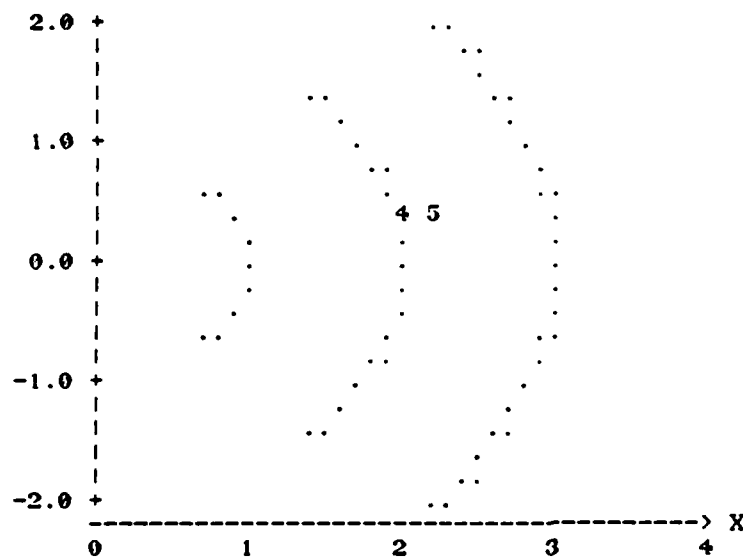File Creation Date : THU, AUG 11 1983   System time   19:41:05

```
                    **  MODEL1 PARAMETERS  **
        HEIGHT FILTER COEFFICIENT =        0.25
        SLOPE FILTER COEFFICIENT  =        0.85
        LEVEL GROUND STEP THRESHOLD =      0.25 METERS
        SLOPE THRESHOLD =                  30.00 DEGREES
```



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 2.0 +                         . .
     I                           . .
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     I             . .                . .
     I              .                .
 1.0 +                       .
     I                     . .               .
     I           . .                    . .
     I                         4 5           .
     I
 0.0 +    .                  .        .
     I                                .
     I           . .                    .
     I                                 .
     I           . .                 . .
-1.0 +             .                .
     I                    .       .
     I                       .
     I           . .              . .
     I                         .
-2.0 +                     . .
     ----------------------------------------------> X
      0          1         2         3         4
```

                    X vs. Y for
                    hazards of
                      scan # 1

                    Number key:
                    1 -- Insufficient data
                    2 -- Furthest return .LT. 1.5m
                    3 -- Slope hazard
                    4 -- Step hazard
                    5 -- Crosspath hazard
                    6 -- Bad data

                    Points off scale: 0

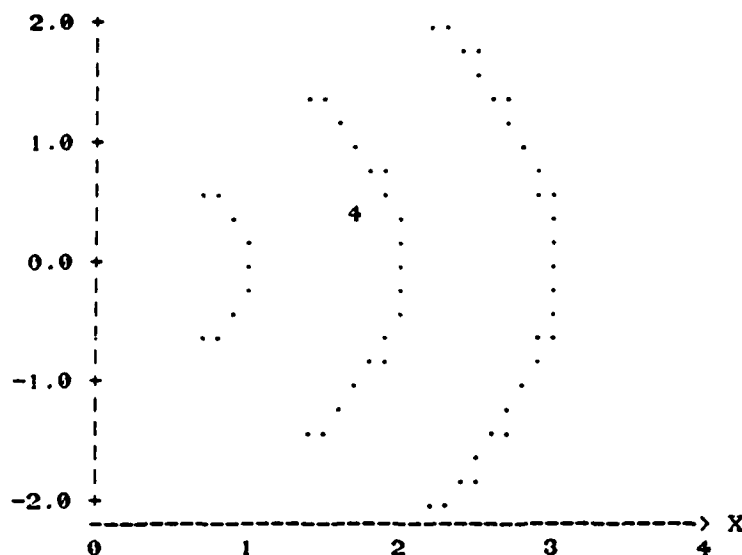| AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	N O	H A Z A R D S	C A T A L O G E D		
16	-1.41	N O	H A Z A R D S	C A T A L O G E D		
17	1.40	N O	H A Z A R D S	C A T A L O G E D		
18	4.21	N O	H A Z A R D S	C A T A L O G E D		
19	7.02	N O	H A Z A R D S	C A T A L O G E D		
20	9.83	N O	H A Z A R D S	C A T A L O G E D		
21	12.64	2.04	1.99	0.45	-0.01	Step hazard
		2.25	2.20	0.49	-0.01	Crosspath hazard
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.SLOPE.25.30.85
File Creation Date : THU, AUG 11 1983   System time   19:41:44

**   MODEL1 PARAMETERS   **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.85
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

X vs. Y for
hazards of
   scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	N O	H A Z A R D S	C A T A L O G E D		
16	-1.41	N O	H A Z A R D S	C A T A L O G E D		
17	1.40	1.84	1.84	0.05	0.12	Step hazard
19	7.02	N O	H A Z A R D S	C A T A L O G E D		
20	9.83	N O	H A Z A R D S	C A T A L O G E D		
21	12.64	N O	H A Z A R D S	C A T A L O G E D		
22	15.45	1.72	1.66	0.46	-0.01	Step hazard
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

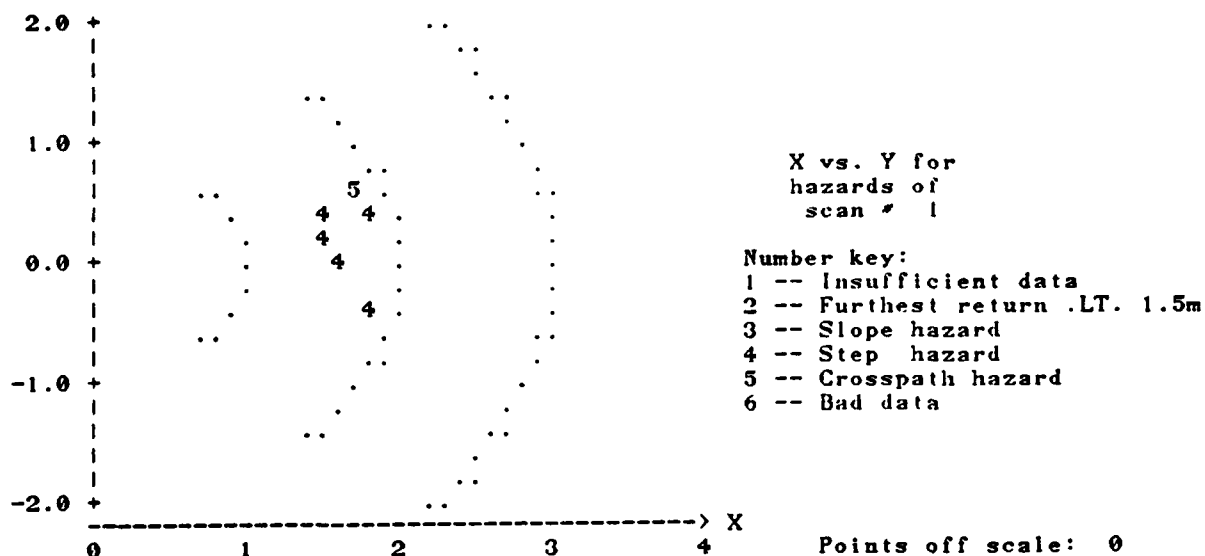Input file: MDL.SLOPE.30.30.85
File Creation Date : THU, AUG 11 1983   System time   19:42:39

**   ** MODEL1 PARAMETERS **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.85
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

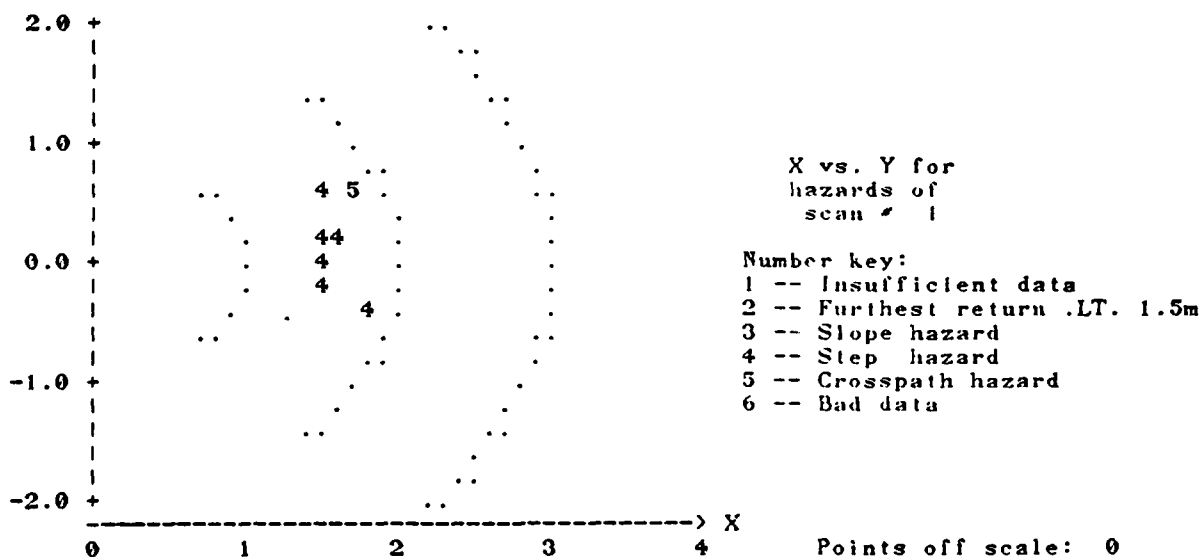| AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S		C A T A L O G E D	
2	-40.74	N O	H A Z A R D S		C A T A L O G E D	
3	-37.93	N O	H A Z A R D S		C A T A L O G E D	
4	-35.13	N O	H A Z A R D S		C A T A L O G E D	
5	-32.31	N O	H A Z A R D S		C A T A L O G E D	
6	-29.50	N O	H A Z A R D S		C A T A L O G E D	
7	-26.69	N O	H A Z A R D S		C A T A L O G E D	
8	-23.88	N O	H A Z A R D S		C A T A L O G E D	
9	-21.08	N O	H A Z A R D S		C A T A L O G E D	
10	-18.26	N O	H A Z A R D S		C A T A L O G E D	
11	-15.45	N O	H A Z A R D S		C A T A L O G E D	
12	-12.64	N O	H A Z A R D S		C A T A L O G E D	
13	-9.84	1.84	1.81	-0.31	0.19	Step hazard
14	-7.02	1.61	1.60	-0.20	0.04	Step hazard
15	-4.22	N O	H A Z A R D S		C A T A L O G E D	
16	-1.41	1.61	1.61	-0.04	0.04	Step hazard
17	1.40	1.61	1.61	0.04	0.05	Step hazard
		1.73	1.73	0.04	0.18	Step hazard
18	4.21	1.61	1.61	0.12	0.05	Step hazard
19	7.02	N O	H A Z A R D S		C A T A L O G E D	
20	9.83	N O	H A Z A R D S		C A T A L O G E D	
21	12.64	N O	H A Z A R D S		C A T A L O G E D	
22	15.45	1.61	1.55	0.43	0.04	Step hazard
		1.82	1.76	0.49	0.15	Step hazard
23	18.26	1.55	1.47	0.49	-0.01	Step hazard
		1.75	1.66	0.55	-0.01	Crosspath hazard
24	21.07	N O	H A Z A R D S		C A T A L O G E D	
25	23.88	N O	H A Z A R D S		C A T A L O G E D	
26	26.69	N O	H A Z A R D S		C A T A L O G E D	
27	29.50	N O	H A Z A R D S		C A T A L O G E D	
28	32.31	N O	H A Z A R D S		C A T A L O G E D	
29	35.12	N O	H A Z A R D S		C A T A L O G E D	
30	37.93	N O	H A Z A R D S		C A T A L O G E D	
31	40.74	N O	H A Z A R D S		C A T A L O G E D	
32	43.55	N O	H A Z A R D S		C A T A L O G E D	

Input file: MDL.SLOPE.35.30.85
File Creation Date : THU. AUG 11 1983   System time   19:43:15

```
          **   MODFL1 PARAMETERS   **
      HEIGHT FILTER COEFFICIENT  :        0.25
      SLOPE FILTER COEFFICIENT   :        0.85
      LEVEL GROUND STEP THRESHOLD =       0.25 METERS
      SLOPE THRESHOLD :                  30.00 DEGREES
```

```
 2.0 +              . .
     |
     |                . .          .
     |                 .
 1.0 +                 . .       .
     |               4 5 .         . .        X vs. Y for
     |              .         .     .          hazards of
     |            .  433          .             scan / 1
 0.0 +          . 4  44       .
     |          . 44 4        .               Number key:
     |           .     4    .                 1 -- Insufficient data
     |            . .        .                2 -- Furthest return .LT. 1.5m
     |              . .                        3 -- Slope hazard
-1.0 +                . .                      4 -- Step  hazard
     |                 .                       5 -- Crosspath hazard
     |                  . .                    6 -- Bad data
     |                 . .
-2.0 +                . .
     ---------------------------------------> X
        0       1       2       3       4        Points off scale:  0
```

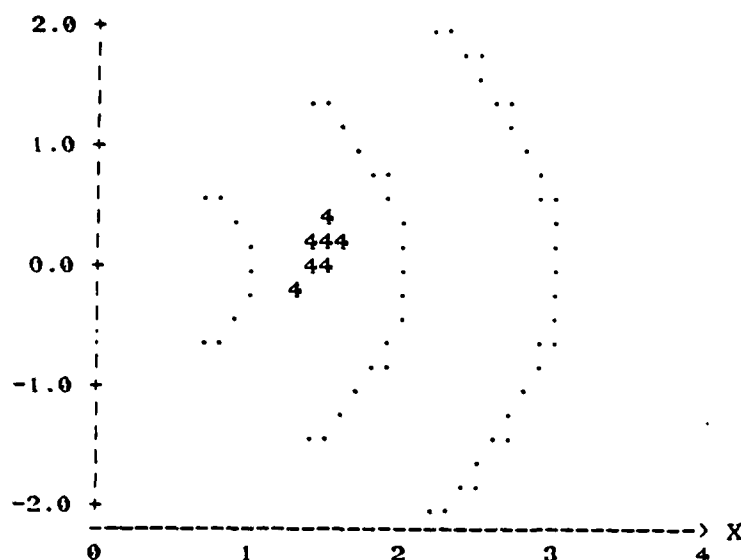| AZ IMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	1.30	1.28	-0.22	-0.05	Step hazard
		1.51	1.49	-0.26	0.07	Step hazard
		1.82	1.79	-0.31	0.27	Step hazard
14	-7.02	1.26	1.23	-0.15	-0.14	Step hazard
		1.51	1.50	-0.19	0.07	Step hazard
15	-4.22	1.51	1.51	-0.11	0.04	Step hazard
		1.51	1.51	-0.11	0.04	Step hazard
16	-1.41	1.30	1.30	-0.03	-0.05	Step hazard
		1.51	1.51	-0.04	0.06	Step hazard
17	1.40	1.51	1.51	0.04	0.07	Step hazard
		1.63	1.62	0.04	0.23	Step hazard
18	4.21	1.56	1.56	0.11	0.18	Slope hazard
		1.63	1.62	0.12	0.23	Slope hazard
		1.72	1.72	0.13	0.30	Slope hazard
19	7.02	1.51	1.50	0.19	0.06	Step hazard
20	9.83	1.51	1.49	0.26	0.07	Step hazard
21	12.64	N O	H A Z A R D S	C A T A L O G E D		
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	1.61	1.53	0.50	0.07	Step hazard
		1.75	1.66	0.53	0.07	Crosspath hazard
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.SLOPE.40.30.85
File Creation Date : THU, AUG 11 1983   System time   19:44:10

** MODEL1 PARAMETERS **

HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.85
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

```
 2.0 +                                  . .
     I                                      . .
     I
     I                       . .               . .
     I
 1.0 +                          . .          .
     I                                                 X vs. Y for
     I                        . .               . .    hazards of
     I               . .          4        .             scan #  1
     I               .          4 3     .           .
 0.0 +               .          4         .         .    Number key:
     I               .          444     .               1 -- Insufficient data
     I                                     .             2 -- Furthest return .LT. 1.5m
     I                . .                  . .           3 -- Slope hazard
     I                       . .          .              4 -- Step  hazard
-1.0 +                                     .             5 -- Crosspath hazard
     I                                                   6 -- Bad data
     I                . .               . .
     I
     I
-2.0 +                     . .
     ----------------------------------------------> X
     0        1        2        3        4          Points off scale:  0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	1.34	1.31	-0.29	0.07	Step hazard
13	-9.84	1.37	1.35	-0.23	0.12	Step hazard
14	-7.02	1.42	1.41	-0.17	0.13	Step hazard
15	-4.22	1.37	1.37	-0.10	0.12	Step hazard
		1.47	1.47	-0.11	0.22	Step hazard
16	-1.41	1.42	1.42	-0.03	0.13	Step hazard
17	1.40	1.42	1.42	0.03	0.13	Step hazard
18	4.21	1.42	1.42	0.10	0.13	Step hazard
19	7.02	1.42	1.41	0.17	0.13	Step hazard
		1.63	1.62	0.20	0.34	Slope hazard
20	9.83	1.42	1.40	0.24	0.13	Step hazard
21	12.64	N O	H A Z A R D S	C A T A L O G E D		
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	1.60	1.51	0.50	0.23	Step hazard
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

7.2.2.3 <u>B=0.80</u>; <u>Slope</u> <u>Threshold=30</u>
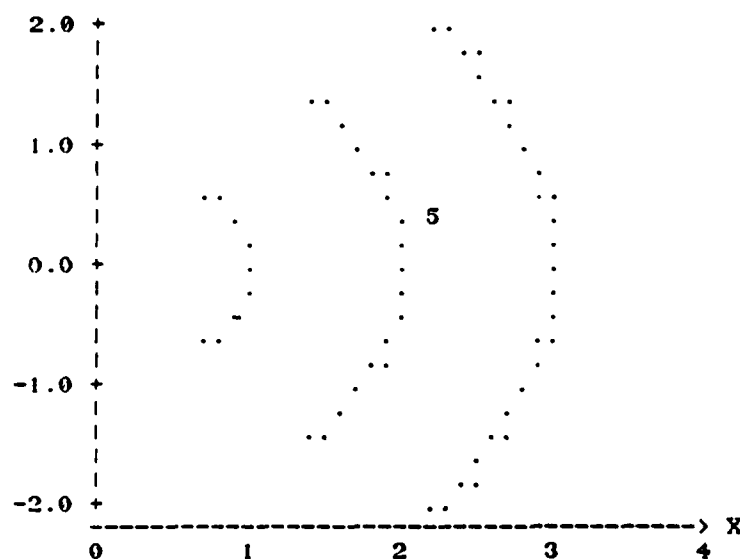
Input file: MDL.SLOPE.05.30.80
File Creation Date : THU. AUG 11 1983   System time   20:00:19

** MODEL1 PARAMETERS **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.80
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

NO HAZARDS CATALOGED THIS SCAN

Input file: MDL.SLOPE.10.30.80
File Creation Date : THU. AUG 11 1983   System time   20:01:18

** MODEL1 PARAMETERS **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.80
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return LT 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale   0

NO HAZARDS CATALOGED THIS SCAN

Input file: MDL.SLOPE.15.30.80
File Creation Date : THU, AUG 11 1983   System time   20:01:47

**   MODEL1 PARAMETERS   **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.80
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

```
  2.0 +                         . .
      |                      .          .
      |                    .              .
  1.0 +               .                      .
      |         . .                       . .
      |       .             4  . 5          .
      |                     4                 .
  0.0 +       .             4  .               .
      |                     4                  .
      |         . .                          .
  -1.0 +             . .                   . .
      |                  .              .
      |                   .          .
  -2.0 +                      . .
      ----------------------------------------> X
      0         1         2         3         4
```

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

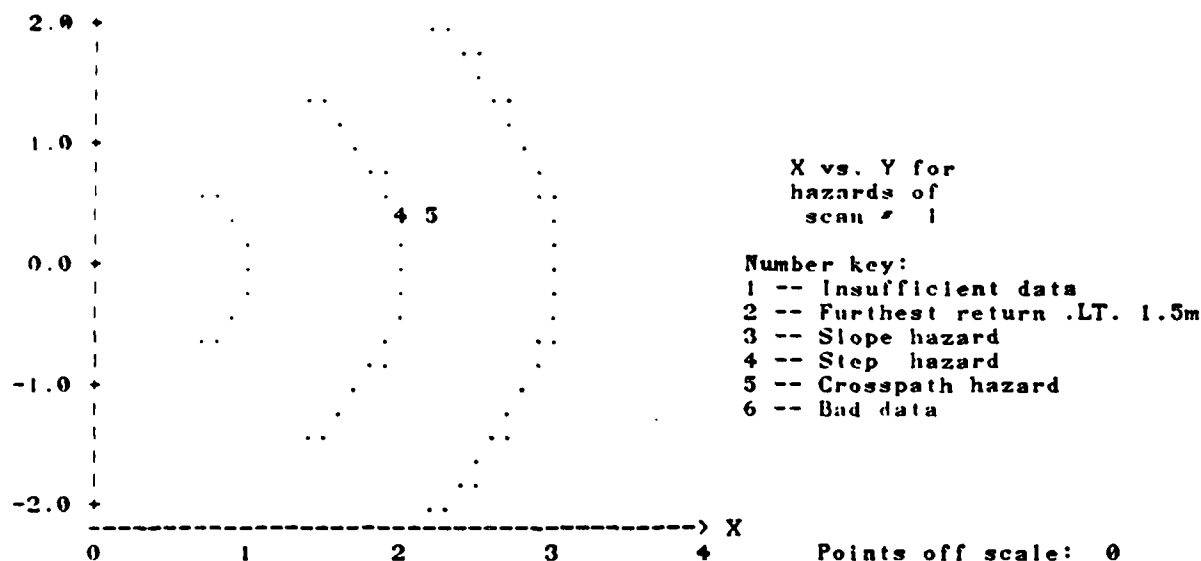| AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	1.84	1.83	-0.13	-0.08	Step hazard
16	-1.41	1.84	1.84	-0.05	-0.08	Step hazard
17	1.40	1.84	1.84	0.05	-0.08	Step hazard
18	4.21	N O	H A Z A R D S	C A T A L O G E D		
19	7.02	1.84	1.82	0.22	-0.08	Step hazard
20	9.83	1.84	1.81	0.31	-0.08	Step hazard
21	12.64	2.25	2.20	0.49	-0.04	Crosspath hazard
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.SLOPE.20.30.80
File Creation Date : THU. AUG 11 1983   System time   20:02:47

** MODEL1 PARAMETERS **

HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.80
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
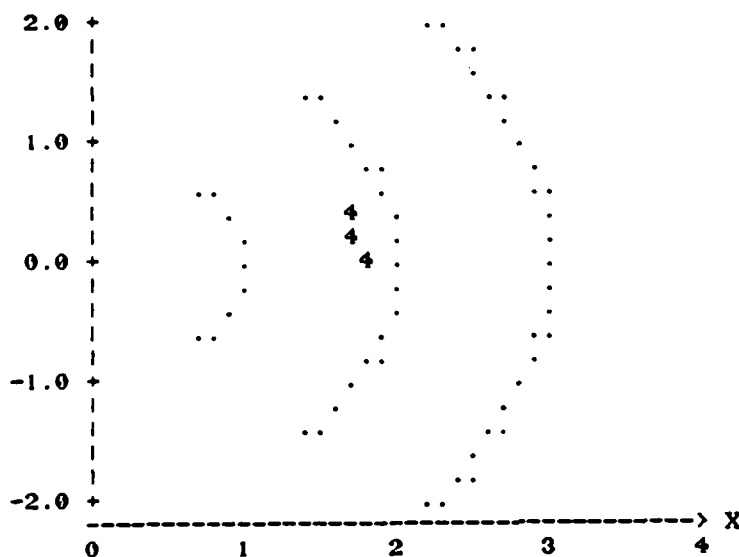SLOPE THRESHOLD =   30.00 DEGREES

```
2.0 +                          . .
    |                             . .
    |
    |                  . .           . .
    |
1.0 +
    |                     . .          .          X vs. Y for
    |                                              hazards of
    |               . .        .    4 5    .        scan # 1
    |              .         4           .
0.0 +              .         4           .          Number key:
    |                                              1 -- Insufficient data
    |                                              2 -- Furthest return .LT. 1.5m
    |               . .        .        . .        3 -- Slope hazard
    |            .                                 4 -- Step  hazard
-1.0 +                . .          .                5 -- Crosspath hazard
    |                                              6 -- Bad data
    |                  . .           . .
    |                       . .
-2.0 +                      . .
    -------------------------------------------> X
    0       1       2       3       4          Points off scale:  0
```
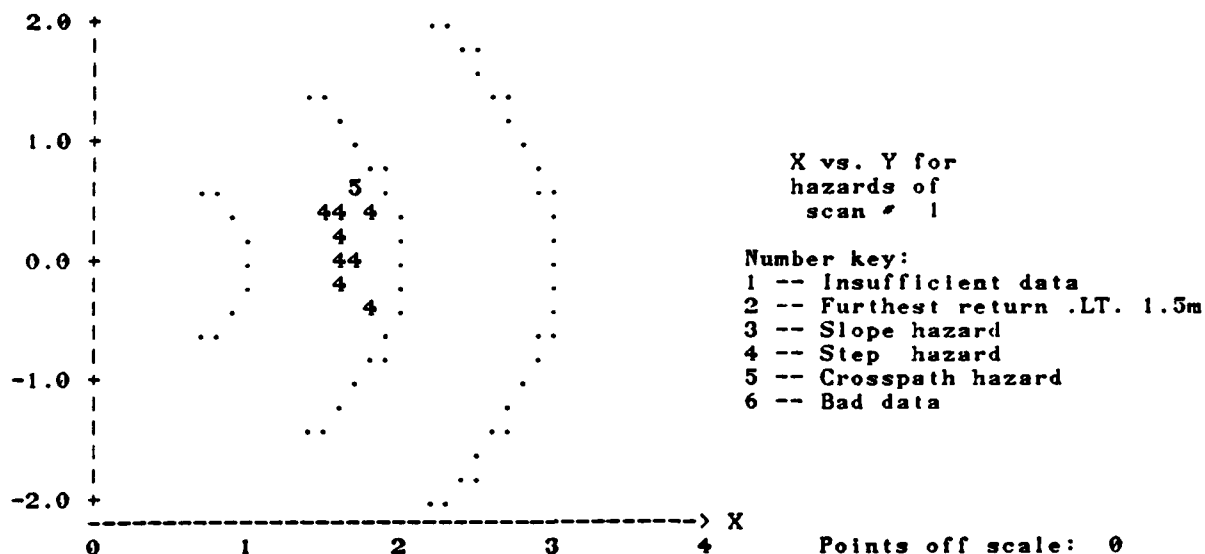
AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T	A L O C E D	
2	-40.74	N O	H A Z A R D S	C A T A L O C E D		
3	-37.93	N O	H A Z A R D S	C A T A L O C E D		
4	-35.13	N O	H A Z A R D S	C A T A L O C E D		
5	-32.31	N O	H A Z A R D S	C A T A L O C E D		
6	-29.50	N O	H A Z A R D S	C A T A L O C E D		
7	-26.69	N O	H A Z A R D S	C A T A L O C E D		
8	-23.88	N O	H A Z A R D S	C A T A L O C E D		
9	-21.08	N O	H A Z A R D S	C A T A L O C E D		
10	-18.26	N O	H A Z A R D S	C A T A L O C E D		
11	-15.45	N O	H A Z A R D S	C A T A L O C E D		
12	-12.64	N O	H A Z A R D S	C A T A L O C E D		
13	-9.84	N O	H A Z A R D S	C A T A L O C E D		
14	-7.02	N O	H A Z A R D S	C A T A L O C E D		
15	-4.22	N O	H A Z A R D S	C A T A L O C E D		
16	-1.41	1.51	1.51	-0.04	-0.15	Step hazard
17	1.40	1.51	1.51	0.04	-0.14	Step hazard
18	4.21	N O	H A Z A R D S	C A T A L O C E D		
19	7.02	1.51	1.50	0.18	-0.14	Step hazard
20	9.83	1.51	1.48	0.26	-0.15	Step hazard
21	12.64	2.04	1.99	0.45	-0.01	Step hazard
		2.25	2.20	0.49	-0.01	Crosspath hazard
22	15.45	N O	H A Z A R D S	C A T A L O C E D		
23	18.26	N O	H A Z A R D S	C A T A L O C E D		
24	21.07	N O	H A Z A R D S	C A T A L O C E D		
25	23.88	N O	H A Z A R D S	C A T A L O C E D		
26	26.69	N O	H A Z A R D S	C A T A L O C E D		
27	29.50	N O	H A Z A R D S	C A T A L O C E D		
28	32.31	N O	H A Z A R D S	C A T A L O C E D		
29	35.12	N O	H A Z A R D S	C A T A L O C E D		
30	37.93	N O	H A Z A R D S	C A T A L O C E D		
31	40.74	N O	H A Z A R D S	C A T A L O C E D		
32	43.55	N O	H A Z A R D S	C A T A L O C E D		

Input file: MDL.SLOPE.25.30.80
File Creation Date : THU, AUG 11 1983   System time   20:03:15

** MODEL1 PARAMETERS **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.80
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

```
 2.0 +                              ..
     I                                   ..
     I                          ..           ..
     I
 1.0 +            ..                    .
     I                          ..            .
     I    ..              .                      ..
     I                           4   .
     I            .             43  .                    X vs. Y for
 0.0 +            .              4  .             .       hazards of
     I                                           .         scan # 1
     I            .                       .
     I                           .                    Number key:
     I    ..                          .               1 -- Insufficient data
     I            ..              .              .     2 -- Furthest return .LT. 1.5m
-1.0 +                     ..                .         3 -- Slope hazard
     I            .                       .            4 -- Step  hazard
     I                    ..            ..             5 -- Crosspath hazard
     I            ..                 ..                6 -- Bad data
     I
-2.0 +                     ..              .
     ------------------------------------------> X
     0         1         2         3         4        Points off scale:  0
```

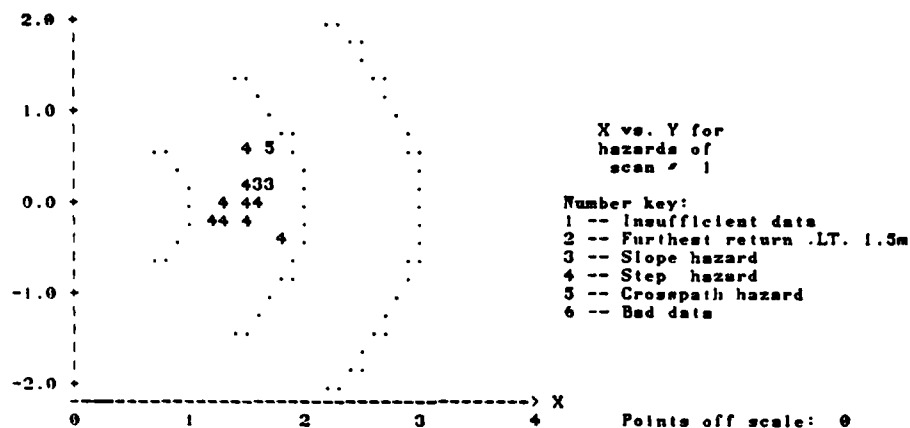| AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	N O	H A Z A R D S	C A T A L O G E D		
16	-1.41	N O	H A Z A R D S	C A T A L O G E D		
17	1.40	1.84	1.84	0.05	0.12	Step hazard
18	4.21	1.72	1.71	0.13	0.00	Step hazard
19	7.02	1.84	1.82	0.22	0.11	Slope hazard
20	9.83	N O	H A Z A R D S	C A T A L O G E D		
21	12.64	N O	H A Z A R D S	C A T A L O G E D		
22	15.45	1.72	1.66	0.46	-0.01	Step hazard
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.SLOPE.30.30.80
File Creation Date : THU, AUG 11 1983   System time   20:03:41

```
            **   MODEL1 PARAMETERS  **
      HEIGHT FILTER COEFFICIENT =      0.25
      SLOPE FILTER COEFFICIENT  =      0.80
      LEVEL GROUND STEP THRESHOLD =    0.25 METERS
      SLOPE THRESHOLD =               30.00 DEGREES
```

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	NO	HAZARDS	CATALOGED		
2	-40.74	NO	HAZARDS	CATALOGED		
3	-37.93	NO	HAZARDS	CATALOGED		
4	-35.13	NO	HAZARDS	CATALOGED		
5	-32.31	NO	HAZARDS	CATALOGED		
6	-29.50	NO	HAZARDS	CATALOGED		
7	-26.69	NO	HAZARDS	CATALOGED		
8	-23.88	NO	HAZARDS	CATALOGED		
9	-21.08	NO	HAZARDS	CATALOGED		
10	-18.26	NO	HAZARDS	CATALOGED		
11	-15.45	NO	HAZARDS	CATALOGED		
12	-12.64	NO	HAZARDS	CATALOGED		
13	-9.84	1.40	1.38	-0.24	-0.06	Step hazard
		1.84	1.81	-0.31	0.19	Step hazard
14	-7.02	1.40	1.39	-0.17	-0.06	Step hazard
15	-4.22	1.40	1.40	-0.10	-0.06	Step hazard
16	-1.41	1.40	1.40	-0.03	-0.06	Step hazard
17	1.40	1.40	1.40	0.03	-0.06	Step hazard
		1.61	1.61	0.04	0.05	Step hazard
		1.73	1.73	0.04	0.18	Slope hazard
		1.82	1.82	0.04	0.25	Slope hazard
18	4.21	1.40	1.40	0.10	-0.06	Step hazard
		1.61	1.61	0.12	0.05	Step hazard
		1.73	1.72	0.13	0.18	Slope hazard
19	7.02	1.40	1.39	0.17	-0.06	Step hazard
20	9.83	1.40	1.38	0.24	-0.06	Step hazard
21	12.64	1.40	1.37	0.31	-0.06	Step hazard
22	15.45	1.40	1.35	0.37	-0.06	Step hazard
		1.82	1.76	0.49	0.15	Step hazard
23	18.26	1.55	1.37	0.49	-0.01	Step hazard
		1.75	1.66	0.55	-0.01	Crosspath hazard
24	21.07	NO	HAZARDS	CATALOGED		
25	23.88	NO	HAZARDS	CATALOGED		
26	26.69	NO	HAZARDS	CATALOGED		
27	29.50	NO	HAZARDS	CATALOGED		
28	32.31	NO	HAZARDS	CATALOGED		
29	35.12	NO	HAZARDS	CATALOGED		
30	37.93	NO	HAZARDS	CATALOGED		
31	40.74	NO	HAZARDS	CATALOGED		
32	43.55	NO	HAZARDS	CATALOGED		

Input file: MDL.SLOPE.35.30.80
File Creation Date : THU, AUG 11 1983   System time   20:04:08
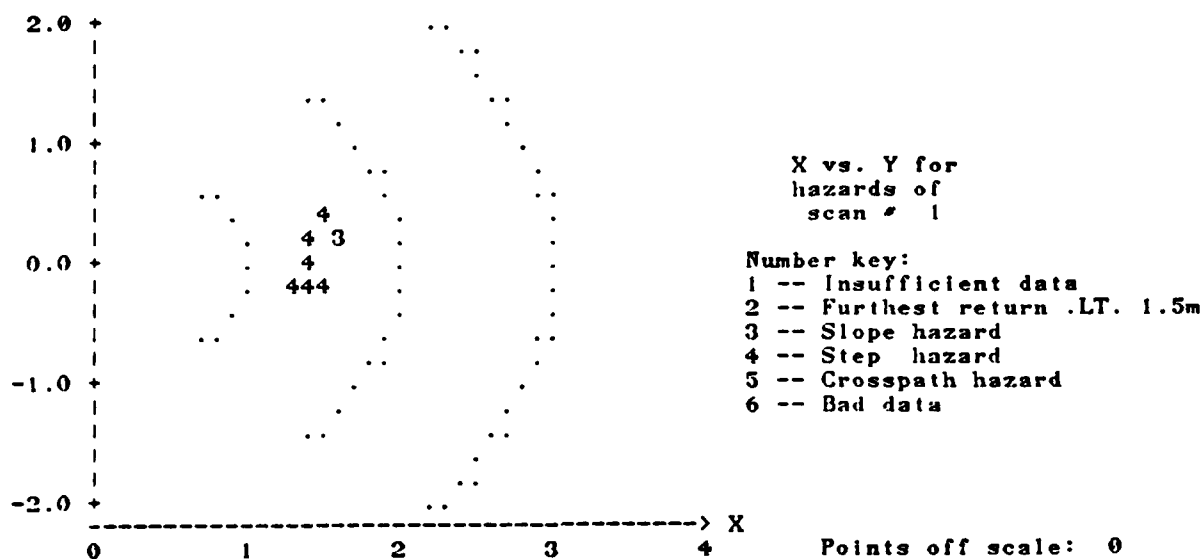
** MODEL1 PARAMETERS **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.80
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

```
2.0 +                    . .
    |                 . .        . .
1.0 +           .         .
    |      . .     4 5 .         .        X vs. Y for
    |              4              .       hazards of
    |         . 4  333  .                 scan # 1
0.0 +         . 3 433  .          .       Number key:
    |         . 4  43   .                 1 -- Insufficient data
    |               4   .                 2 -- Furthest return .LT. 1.5m
    |      . .          . .               3 -- Slope hazard
-1.0 +          . .                       4 -- Step  hazard
    |              . .                     5 -- Crosspath hazard
    |                                      6 -- Bad data
-2.0 +         . .
    --------------------------------> X
    0      1      2      3      4        Points off scale:  0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T	A L O G E D	
2	-40.74	N O	H A Z A R D S	C A T	A L O G E D	
3	-37.93	N O	H A Z A R D S	C A T	A L O G E D	
4	-35.13	N O	H A Z A R D S	C A T	A L O G E D	
5	-32.31	N O	H A Z A R D S	C A T	A L O G E D	
6	-29.50	N O	H A Z A R D S	C A T	A L O G E D	
7	-26.69	N O	H A Z A R D S	C A T	A L O G E D	
8	-23.88	N O	H A Z A R D S	C A T	A L O G E D	
9	-21.08	N O	H A Z A R D S	C A T	A L O G E D	
10	-18.26	N O	H A Z A R D S	C A T	A L O G E D	
11	-13.45	N O	H A Z A R D S	C A T	A L O G E D	
12	-12.64	N O	H A Z A R D S	C A T	A L O G E D	
13	-9.84	1.34	1.32	-0.23	0.07	Slope hazard
		1.56	1.54	-0.27	0.17	Slope hazard
		1.82	1.79	-0.31	0.27	Step hazard
14	-7.02	1.30	1.29	-0.16	-0.06	Step hazard
		1.56	1.55	-0.19	0.17	Slope hazard
		1.63	1.61	-0.20	0.23	Slope hazard
15	-4.22	1.51	1.51	-0.11	0.04	Step hazard
16	-1.41	1.34	1.34	-0.03	0.07	Slope hazard
		1.51	1.51	-0.04	0.06	Step hazard
		1.63	1.62	-0.04	0.23	Slope hazard
17	1.40	1.56	1.56	0.04	0.17	Slope hazard
		1.63	1.62	0.04	0.23	Slope hazard
		1.72	1.72	0.04	0.30	Slope hazard
18	4.21	1.51	1.51	0.11	0.12	Slope hazard
		1.56	1.56	0.11	0.18	Slope hazard
		1.63	1.62	0.12	0.23	Slope hazard
		1.72	1.72	0.13	0.30	Slope hazard
19	7.02	1.23	1.22	0.15	-0.10	Step hazard
20	9.83	1.20	1.18	0.21	-0.06	Step hazard
		1.26	1.24	0.21	0.01	Step hazard
		1.55	1.54	0.27	0.17	Slope hazard
		1.63	1.60	0.28	0.23	Slope hazard
21	12.64	N O	H A Z A R D S	C A T	A L O G E D	
22	15.45	1.51	1.46	0.40	0.07	Step hazard
23	18.26	1.61	1.53	0.50	0.07	Step hazard
		1.73	1.66	0.55	0.07	Crosspath hazard
24	21.07	N O	H A Z A R D S	C A T	A L O G E D	
25	23.88	N O	H A Z A R D S	C A T	A L O G E D	
26	26.69	N O	H A Z A R D S	C A T	A L O G E D	
27	29.50	N O	H A Z A R D S	C A T	A L O G E D	
28	32.31	N O	H A Z A R D S	C A T	A L O G E D	
29	35.12	N O	H A Z A R D S	C A T	A L O G E D	
30	37.93	N O	H A Z A R D S	C A T	A L O G E D	
31	40.74	N O	H A Z A R D S	C A T	A L O G E D	
32	43.55	N O	H A Z A R D S	C A T	A L O G E D	

Input file: MDL.SLOPE.40.30.80
File Creation Date : THU, AUG 11 1983   System time   20:04:40

```
            **  MODEL1 PARAMETERS  **
       HEIGHT FILTER COEFFICIENT =        0.25
       SLOPE FILTER COEFFICIENT  =        0.80
       LEVEL GROUND STEP THRESHOLD =      0.25 METERS
       SLOPE THRESHOLD =                 30.00 DEGREES
```
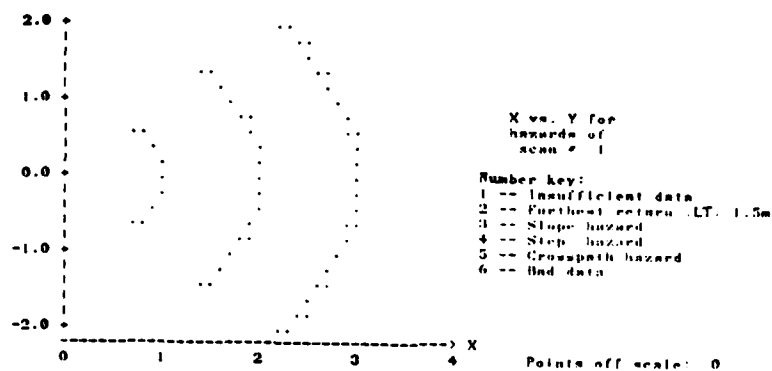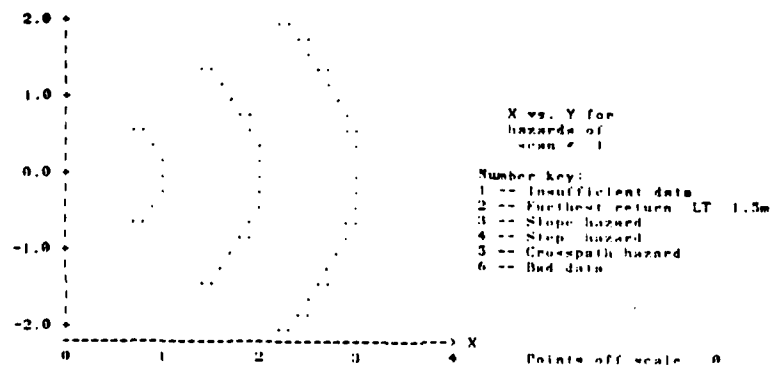


```
X vs. Y for
hazards of
scan #  1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step  hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale:  0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z	A R D S	C A T A L O G E D	
2	-40.74	N O	H A Z	A R D S	C A T A L O G E D	
3	-37.93	N O	H A Z	A R D S	C A T A L O G E D	
4	-35.13	N O	H A Z	A R D S	C A T A L O G E D	
5	-32.31	N O	H A Z	A R D S	C A T A L O G E D	
6	-29.50	N O	H A Z	A R D S	C A T A L O G E D	
7	-26.69	N O	H A Z	A R D S	C A T A L O G E D	
8	-23.88	N O	H A Z	A R D S	C A T A L O G E D	
9	-21.08	N O	H A Z	A R D S	C A T A L O G E D	
10	-18.26	N O	H A Z	A R D S	C A T A L O G E D	
11	-15.45	N O	H A Z	A R D S	C A T A L O G E D	
12	-12.64	1.26	1.23	-0.28	-0.07	Step hazard
		1.34	1.31	-0.29	0.07	Step hazard
13	-9.84	1.47	1.45	-0.25	0.22	Slope hazard
		1.67	1.65	-0.29	0.29	Slope hazard
14	-7.02	1.47	1.46	-0.18	0.22	Slope hazard
15	-4.22	1.47	1.47	-0.11	0.22	Step hazard
		1.47	1.47	-0.11	0.22	Slope hazard
16	-1.41	1.30	1.30	-0.03	0.03	Step hazard
		1.37	1.37	-0.03	0.12	Slope hazard
		1.47	1.47	-0.04	0.22	Slope hazard
		1.59	1.58	-0.04	0.28	Slope hazard
17	1.40	1.30	1.30	0.03	0.03	Step hazard
		1.37	1.37	0.03	0.12	Slope hazard
		1.47	1.47	0.04	0.22	Slope hazard
		1.63	1.63	0.04	0.34	Slope hazard
18	4.21	1.30	1.30	0.10	0.03	Step hazard
		1.37	1.37	0.10	0.12	Slope hazard
		1.47	1.47	0.11	0.22	Slope hazard
		1.63	1.63	0.12	0.34	Slope hazard
19	7.02	1.30	1.29	0.16	0.03	Step hazard
		1.37	1.36	0.17	0.12	Slope hazard
		1.47	1.46	0.18	0.22	Slope hazard
		1.59	1.57	0.19	0.28	Slope hazard
		1.63	1.62	0.20	0.34	Slope hazard
20	9.83	1.30	1.28	0.22	0.03	Step hazard
		1.37	1.35	0.23	0.12	Slope hazard
		1.47	1.45	0.25	0.22	Slope hazard
		1.54	1.51	0.26	0.22	Step hazard
21	12.64	1.54	1.50	0.34	0.23	Step hazard
22	15.45	1.54	1.48	0.41	0.23	Step hazard
23	18.26	1.57	1.48	0.48	0.11	Step hazard
		1.60	1.51	0.50	0.23	Step hazard
24	21.07	N O	H A Z	A R D S	C A T A L O G E D	
25	23.88	N O	H A Z	A R D S	C A T A L O G E D	
26	26.69	N O	H A Z	A R D S	C A T A L O G E D	
27	29.50	N O	H A Z	A R D S	C A T A L O G E D	
28	32.31	N O	H A Z	A R D S	C A T A L O G E D	
29	35.12	N O	H A Z	A R D S	C A T A L O G E D	
30	37.93	N O	H A Z	A R D S	C A T A L O G E D	
31	40.74	N O	H A Z	A R D S	C A T A L O G E D	
32	43.55	N O	H A Z	A R D S	C A T A L O G E D	

7.2.2.4 B=0.75; Slope Threshold=30

133

Input file: MDL.SLOPE.05.30.75
File Creation Date : THU, AUG 11 1983   System time   20:18:23

**   MODEL1 PARAMETERS   **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.75
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
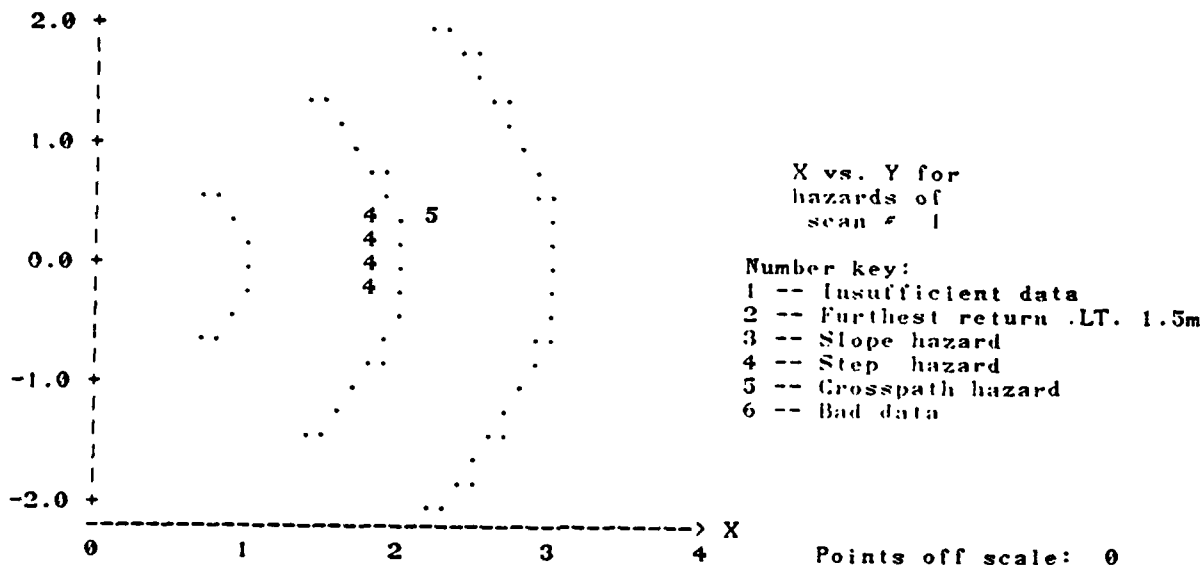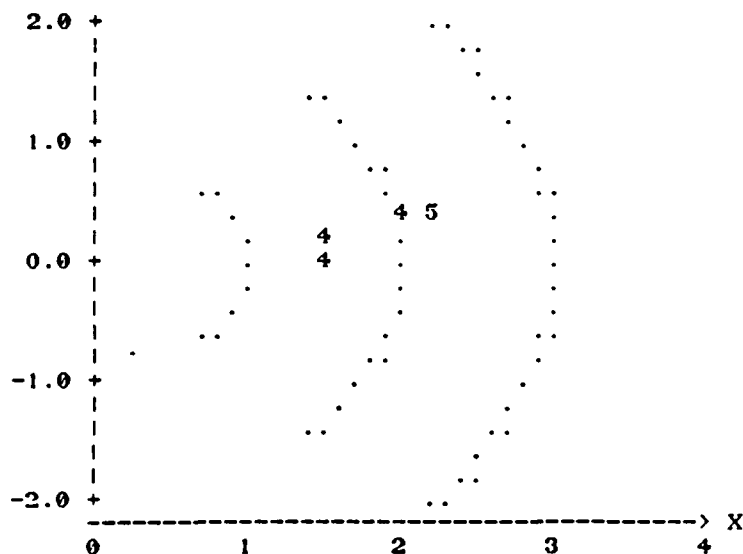SLOPE THRESHOLD =   30.00 DEGREES

X vs. Y for
hazards of
  scan # 1
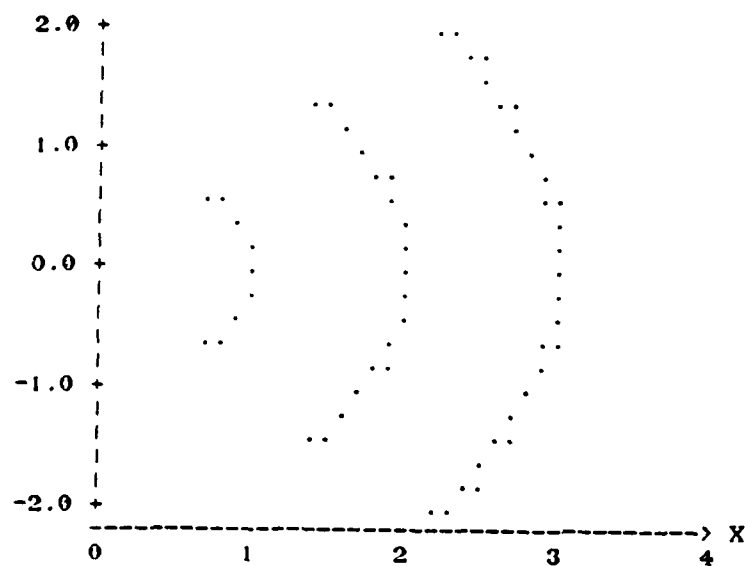
Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

NO HAZARDS CATALOGED THIS SCAN

Input file: MDL.SLOPE.10.30.75
File Creation Date : THU, AUG 11 1983   System time   20:19:31

** MODEL1 PARAMETERS **

HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.75
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

```
2.0 +                              . .
    I                                . .
    I                                  .
    I                             . .       .
1.0 +                                         .
    I                            . .           .
    I                                            . .
    I                      . .                     . .
    I                                4.              .
    I                                 4
0.0 +                      .          4              .
    I                                 4
    I                       .                       .
    I                         .                   . .
    I                           . .             .
-1.0 +                                         .
    I                           . .           .
    I                               .       .
    I                             . .     . .
    I                                 . .
-2.0 +                              . .
    -------------------------------------------> X
    0         1         2         3         4
```

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

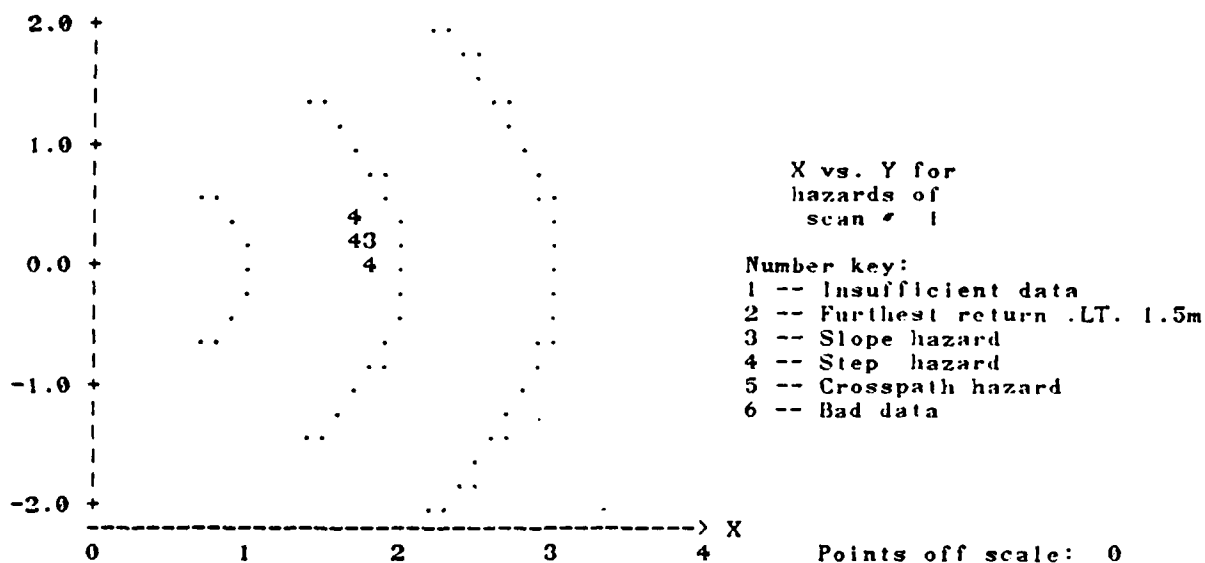Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	1.97	1.96	-0.24	-0.17	Step hazard
15	-4.22	1.97	1.96	-0.14	-0.17	Step hazard
16	-1.41	1.97	1.97	-0.05	-0.17	Step hazard
17	1.40	1.97	1.97	0.05	-0.17	Step hazard
18	4.21	1.97	1.96	0.14	-0.17	Step hazard
19	7.02	1.97	1.96	0.24	-0.17	Step hazard
20	9.83	1.97	1.94	0.34	-0.17	Step hazard
21	12.64	1.97	1.92	0.43	-0.17	Step hazard
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.SLOPE.15.30.75
File Creation Date : THU, AUG 11 1983   System time   20:20:13

```
            **   MODEL1 PARAMETERS   **
      HEIGHT FILTER COEFFICIENT =          0.25
      SLOPE FILTER COEFFICIENT  =          0.75
      LEVEL GROUND STEP THRESHOLD =        0.25 METERS
      SLOPE THRESHOLD =                   30.00 DEGREES
```
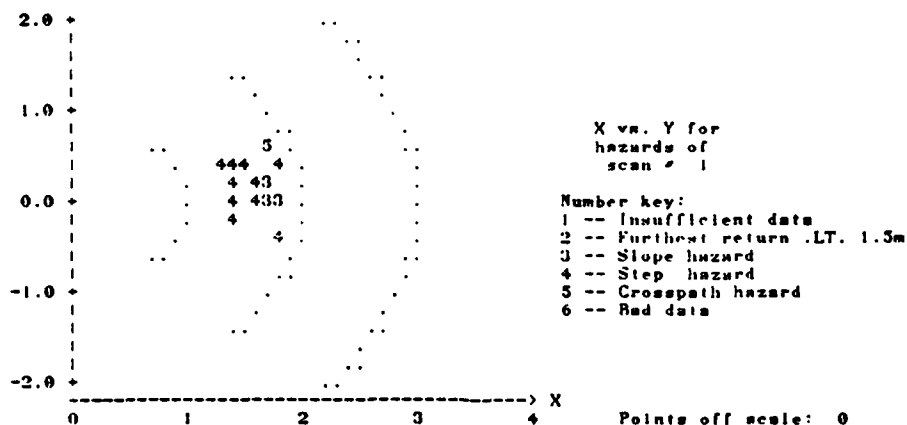
```
  2.0 +
      |                          . .
      |                              . .
      |                   . .        .
  1.0 +            . .                   . .
      |                   . .       .
      |          . .                        . .
      |                    4 . 5         .
      |                    4 .
  0.0 +            .       4 .        .
      |                  4    4 .
  .   |                                  .
      |          . .                        . .
      |                    .            .
 -1.0 +            .           .
      |                  .            .
      |                .                 .
      |          . .
 -2.0 +                  . .
      ----------------------------------------> X
      0          1          2          3          4
```

X vs. Y for
hazards of
  scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	1.40	1.39	-0.17	-0.24	Step hazard
15	-4.22	1.84	1.83	-0.13	-0.08	Step hazard
16	-1.41	1.84	1.84	-0.05	-0.08	Step hazard
17	1.40	1.84	1.84	0.05	-0.08	Step hazard
18	4.21	N O	H A Z A R D S	C A T A L O G E D		
19	7.02	1.84	1.82	0.22	-0.08	Step hazard
20	9.83	1.84	1.81	0.31	-0.08	Step hazard
21	12.64	2.25	2.20	0.49	-0.04	Crosspath hazard
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.SLOPE.20.30.75
File Creation Date : THU, AUG 11 1983   System time   20:20:46

**   MODEL: PARAMETERS   **
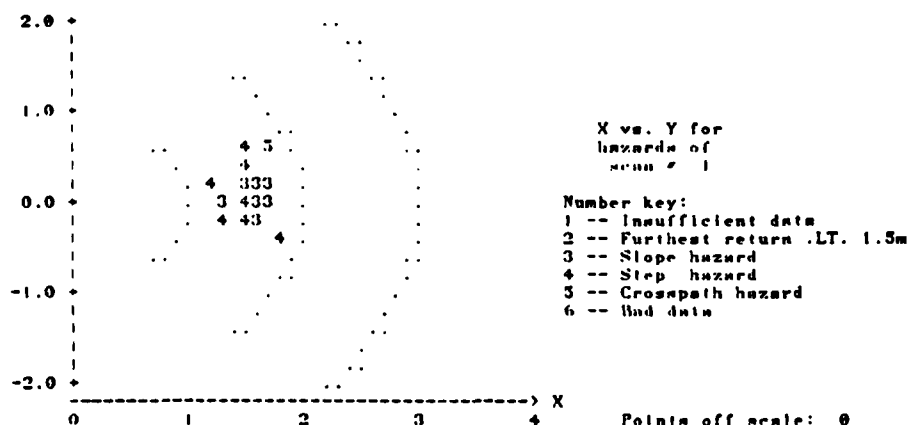   HEIGHT FILTER COEFFICIENT =   0.25
             SLOPE FILTER COEFFICIENT   =   0.75
             LEVEL GROUND STEP THRESHOLD =   0.25 METERS
             SLOPE THRESHOLD =   30.00 DEGREES

```
2.0 +
    |                          ..
    |
    |              ..                  ..
    |
1.0 +                ..              .
    |                                          X vs. Y for
    |          ..              .                hazards of
    |               ..     4  4  5               scan #  1
    |          4
0.0 +           3   4           .               Number key:
    |                     .                       1 -- Insufficient data
    |                                             2 -- Furthest return .LT. 1.5m
    |                                             3 -- Slope hazard
    |          ..              .                  4 -- Step  hazard
-1.0 +                                            5 -- Crosspath hazard
    |                .                            6 -- Bad data
    |
    |               ..
    |
-2.0 +             ..
    ----------------------------------> X
    0       1       2       3       4       Points off scale:  0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S		C A T A L O G E D	
2	-40.74	N O	H A Z A R D S		C A T A L O G E D	
3	-37...	N O	H A Z A R D S		C A T A L O G E D	
4	-35.13	N O	H A Z A R D S		C A T A L O G E D	
5	-32.31	N O	H A Z A R D S		C A T A L O G E D	
6	-29.50	N O	H A Z A R D S		C A T A L O G E D	
7	-26.69	N O	H A Z A R D S		C A T A L O G E D	
8	-23.88	N O	H A Z A R D S		C A T A L O G E D	
9	-21.08	N O	H A Z A R D S		C A T A L O G E D	
10	-18.26	N O	H A Z A R D S		C A T A L O G E D	
11	-15.45	N O	H A Z A R D S		C A T A L O G E D	
12	-12.64	N O	H A Z A R D S		C A T A L O G E D	
13	-9.84	N O	H A Z A R D S		C A T A L O G E D	
14	-7.02	N O	H A Z A R D S		C A T A L O G E D	
15	-4.22	N O	H A Z A R D S		C A T A L O G E D	
16	-1.41	1.51	1.31	-0.04	-0.15	Step hazard
		1.84	1.84	-0.05	-0.07	Step hazard
18	4.21	1.53	1.53	0.11	-0.05	Slope hazard
19	7.02	1.51	1.50	0.18	-0.14	Step hazard
20	9.83	1.31	1.48	0.26	-0.15	Step hazard
		1.84	1.81	0.31	-0.07	Step hazard
21	12.64	1.84	1.79	0.40	-0.07	Step hazard
		2.04	1.99	0.45	-0.01	Step hazard
		2.25	2.20	0.49	-0.01	Crosspath hazard
22	15.45	N O	H A Z A R D S		C A T A L O G E D	
23	18.26	N O	H A Z A R D S		C A T A L O G E D	
24	21.07	N O	H A Z A R D S		C A T A L O G E D	
25	23.88	N O	H A Z A R D S		C A T A L O G E D	
26	26.69	N O	H A Z A R D S		C A T A L O G E D	
27	29.50	N O	H A Z A R D S		C A T A L O G E D	
28	32.31	N O	H A Z A R D S		C A T A L O G E D	
29	35.12	N O	H A Z A R D S		C A T A L O G E D	
30	37.93	N O	H A Z A R D S		C A T A L O G E D	
31	40.74	N O	H A Z A R D S		C A T A L O G E D	
32	43.33	N O	H A Z A R D S		C A T A L O G E D	

Input file: MDL.SLOPE.25.30.75
File Creation Date : THU. AUG 11 1983   System time   20:21:22

```
              **  MODEL1 PARAMETERS  **
        HEIGHT FILTER COEFFICIENT =      0.25
        SLOPE FILTER COEFFICIENT  =      0.75
        LEVEL GROUND STEP THRESHOLD =    0.25 METERS
        SLOPE THRESHOLD =                30.00 DEGREES
```
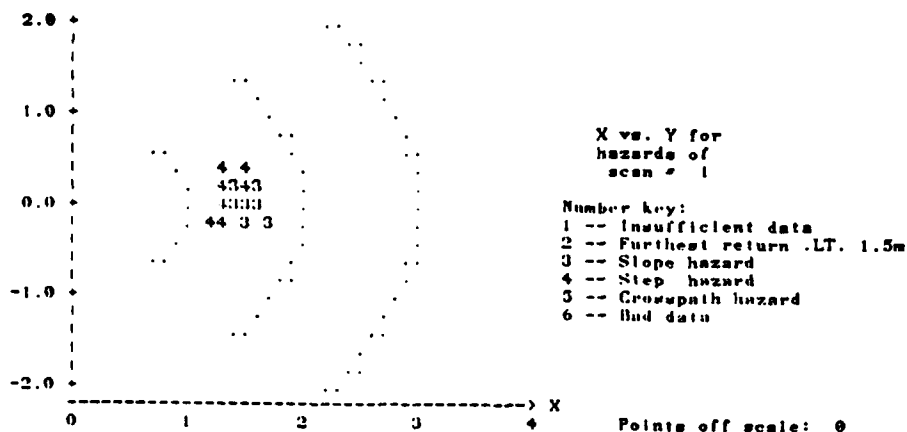


```
X vs. Y for
hazards of
scan = 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale:  0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	NO	HAZARDS		CATALOGED	
2	-40.74	NO	HAZARDS		CATALOGED	
3	-37.93	NO	HAZARDS		CATALOGED	
4	-35.13	NO	HAZARDS		CATALOGED	
5	-32.31	NO	HAZARDS		CATALOGED	
6	-29.50	NO	HAZARDS		CATALOGED	
7	-26.69	NO	HAZARDS		CATALOGED	
8	-23.88	NO	HAZARDS		CATALOGED	
9	-21.08	NO	HAZARDS		CATALOGED	
10	-18.26	NO	HAZARDS		CATALOGED	
11	-15.45	NO	HAZARDS		CATALOGED	
12	-12.64	NO	HAZARDS		CATALOGED	
13	-9.84	NO	HAZARDS		CATALOGED	
14	-7.02	NO	HAZARDS		CATALOGED	
15	-4.22	1.53	1.53	-0.11	-0.05	Slope hazard
		1.65	1.65	-0.12	0.06	Slope hazard
		1.76	1.76	-0.13	0.07	Slope hazard
		1.84	1.83	-0.14	0.11	Slope hazard
16	-1.41	NO	HAZARDS		CATALOGED	
17	1.40	1.93	1.93	0.05	0.19	Slope hazard
18	4.21	1.53	1.53	0.11	-0.05	Slope hazard
		1.76	1.76	0.13	0.07	Slope hazard
		1.84	1.83	0.14	0.11	Slope hazard
19	7.02	1.53	1.52	0.19	-0.05	Slope hazard
		1.65	1.64	0.20	0.00	Slope hazard
		1.76	1.75	0.22	0.07	Slope hazard
		1.84	1.82	0.22	0.11	Slope hazard
20	9.83	NO	HAZARDS		CATALOGED	
21	12.64	NO	HAZARDS		CATALOGED	
22	15.45	1.72	1.66	0.46	-0.01	Step hazard
23	18.26	NO	HAZARDS		CATALOGED	
24	21.07	NO	HAZARDS		CATALOGED	
25	23.88	NO	HAZARDS		CATALOGED	
26	26.69	NO	HAZARDS		CATALOGED	
27	29.50	NO	HAZARDS		CATALOGED	
28	32.31	NO	HAZARDS		CATALOGED	
29	35.12	NO	HAZARDS		CATALOGED	
30	37.93	NO	HAZARDS		CATALOGED	
31	40.74	NO	HAZARDS		CATALOGED	
32	43.55	NO	HAZARDS		CATALOGED	

Input file: MDL.SLOPE.30.30.75
File Creation Date : THU. AUG 11 1983   System time   20:22:04

** MODEL1 PARAMETERS **

HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.75
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	1.43	1.41	-0.24	0.02	Slope hazard
		1.84	1.61	-0.31	0.19	Step hazard
14	-7.02	1.43	1.42	-0.18	0.02	Slope hazard
		1.61	1.60	-0.20	0.04	Step hazard
15	-4.22	1.43	1.43	-0.11	0.02	Slope hazard
		1.60	1.59	-0.12	0.00	Step hazard
16	-1.41	1.43	1.43	-0.04	0.02	Slope hazard
		1.61	1.61	-0.04	0.04	Step hazard
17	1.40	1.43	1.43	0.04	0.02	Slope hazard
		1.66	1.66	0.04	0.13	Slope hazard
		1.73	1.73	0.04	0.18	Slope hazard
		1.82	1.82	0.04	0.25	Slope hazard
18	4.21	1.43	1.43	0.11	0.02	Slope hazard
		1.66	1.65	0.12	0.13	Slope hazard
		1.73	1.72	0.13	0.18	Slope hazard
19	7.02	1.43	1.42	0.18	0.02	Slope hazard
		1.60	1.59	0.20	0.00	Step hazard
20	9.83	1.43	1.41	0.24	0.02	Slope hazard
		1.60	1.57	0.27	0.00	Step hazard
21	12.64	1.43	1.40	0.31	0.02	Slope hazard
		1.60	1.56	0.35	0.00	Step hazard
22	15.45	1.43	1.38	0.38	0.02	Slope hazard
		1.61	1.53	0.43	0.04	Step hazard
		1.82	1.76	0.49	0.15	Step hazard
23	18.26	1.35	1.47	0.49	-0.01	Step hazard
		1.75	1.66	0.55	-0.01	Crosspath hazard
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.SLOPE.35.30.75
File Creation Date : THU, AUG 11 1983   System time   20:22:32

```
                       **   MODEL1 PARAMETERS   **
                    HEIGHT FILTER COEFFICIENT =        0.25
                    SLOPE FILTER COEFFICIENT =         0.75
                    LEVEL GROUND STEP THRESHOLD =      0.25 METERS
                    SLOPE THRESHOLD =                 30.00 DEGREES


     2.0 +                        . .
         I                    . .          . .
         I                 . .               . .
         I              . .                     .
     1.0 +           . .                          .         X vs. Y for
         I          .          4 5 .              . .       hazards of
         I        . .          4 4  .                .        scan # 1
         I        .          433333  .                .
     0.0 +        .          3  333   .               . .   Number key:
         I        .          3  33    .               . .   1 -- Insufficient data
         I        . .             4  .                .      2 -- Furthest return .LT. 1.5m
         I          .                .                .      3 -- Slope hazard
    -1.0 +           . .              .              .       4 -- Step  hazard
         I              . .             .          . .       5 -- Crosspath hazard
         I                 . .               . .            6 -- Bad data
         I                    . .          . .
    -2.0 +                        . .
         +------------------------------------------------> X
         0        1        2        3        4      Points off scale:  0
```

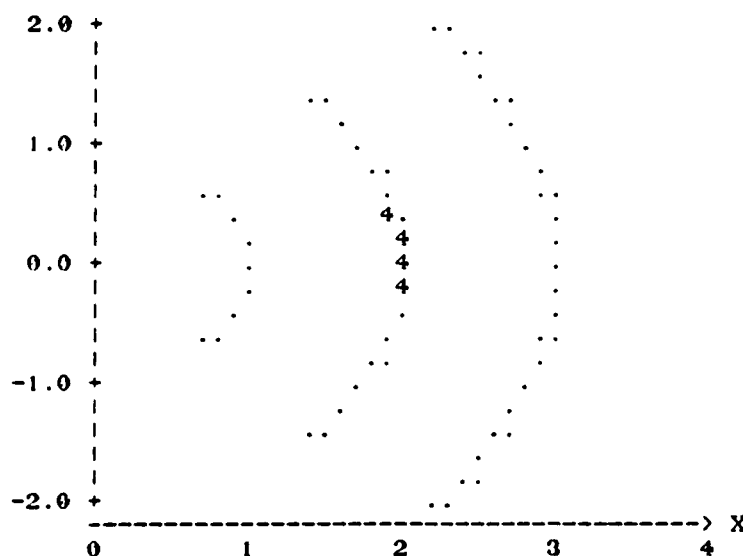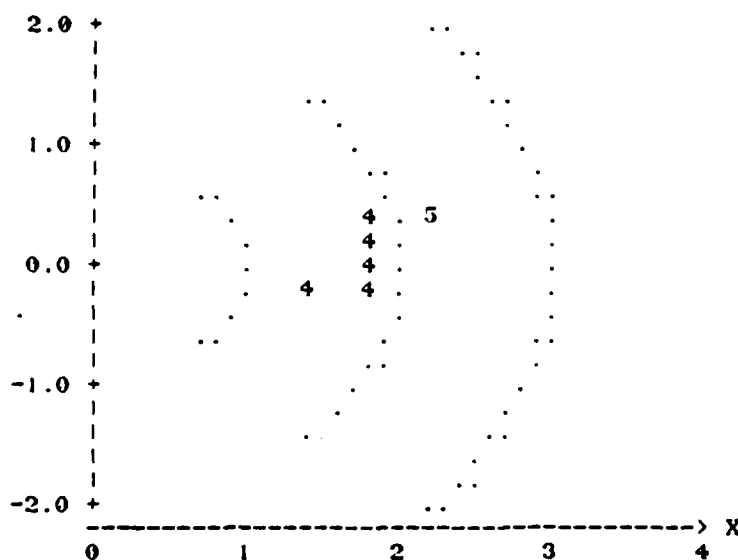| AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	NO	HAZARDS	CATALOGED		
2	-40.74	NO	HAZARDS	CATALOGED		
3	-37.93	NO	HAZARDS	CATALOGED		
4	-35.13	NO	HAZARDS	CATALOGED		
5	-32.31	NO	HAZARDS	CATALOGED		
6	-29.50	NO	HAZARDS	CATALOGED		
7	-26.69	NO	HAZARDS	CATALOGED		
8	-23.88	NO	HAZARDS	CATALOGED		
9	-21.08	NO	HAZARDS	CATALOGED		
10	-18.26	NO	HAZARDS	CATALOGED		
11	-15.45	NO	HAZARDS	CATALOGED		
12	-12.64	NO	HAZARDS	CATALOGED		
13	-9.84	1.34	1.32	-0.23	0.07	Slope hazard
		1.56	1.54	-0.27	0.17	Slope hazard
		1.63	1.60	-0.28	0.18	Slope hazard
		1.82	1.79	-0.31	0.27	Step hazard
14	-7.02	1.34	1.33	-0.16	0.07	Slope hazard
		1.56	1.55	-0.19	0.17	Slope hazard
		1.63	1.61	-0.20	0.23	Slope hazard
15	-4.22	1.56	1.56	-0.11	0.16	Slope hazard
16	-1.41	1.34	1.34	-0.03	0.07	Slope hazard
		1.56	1.56	-0.04	0.17	Slope hazard
		1.63	1.62	-0.04	0.23	Slope hazard
17	1.40	1.45	1.45	0.04	0.07	Slope hazard
		1.56	1.56	0.04	0.17	Slope hazard
		1.63	1.62	0.04	0.23	Slope hazard
		1.72	1.72	0.04	0.30	Slope hazard
18	4.21	1.43	1.43	0.11	0.07	Slope hazard
		1.51	1.51	0.11	0.12	Slope hazard
		1.56	1.56	0.11	0.18	Slope hazard
		1.63	1.62	0.12	0.23	Slope hazard
		1.72	1.72	0.13	0.30	Slope hazard
19	7.02	1.23	1.22	0.15	-0.10	Step hazard
		1.51	1.50	0.19	0.06	Step hazard
		1.63	1.61	0.20	0.23	Slope hazard
20	9.83	1.26	1.24	0.21	0.01	Slope hazard
		1.34	1.32	0.23	0.09	Slope hazard
		1.56	1.54	0.27	0.17	Slope hazard
		1.63	1.60	0.28	0.23	Slope hazard
21	12.64	1.20	1.17	0.26	-0.07	Step hazard
		1.51	1.48	0.33	0.07	Step hazard
22	15.45	1.30	1.26	0.35	0.02	Step hazard
		1.51	1.46	0.40	0.07	Step hazard
23	18.26	1.61	1.53	0.50	0.07	Step hazard
		1.75	1.66	0.55	0.07	Crosspath hazard
24	21.07	NO	HAZARDS	CATALOGED		
25	23.88	NO	HAZARDS	CATALOGED		
26	26.69	NO	HAZARDS	CATALOGED		
27	29.50	NO	HAZARDS	CATALOGED		
28	32.31	NO	HAZARDS	CATALOGED		
29	35.12	NO	HAZARDS	CATALOGED		
30	37.93	NO	HAZARDS	CATALOGED		
31	40.74	NO	HAZARDS	CATALOGED		
32	43.55	NO	HAZARDS	CATALOGED		

Input file: MDL.SLOPE.40.30.75
File Creation Date : THU, AUG 11 1983   System time   20:22:59

**   MODEL1 PARAMETERS   **
REIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.75
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

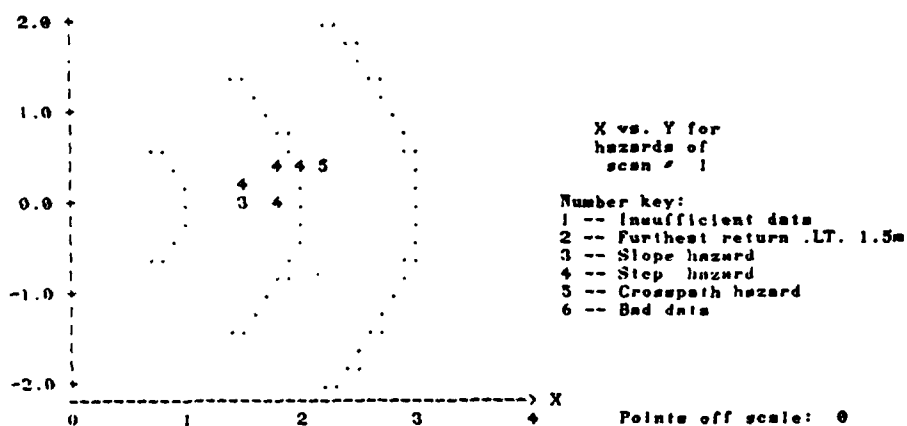| AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	1.26	1.23	-0.28	-0.07	Step hazard
		1.34	1.31	-0.29	0.07	Step hazard
13	-9.84	1.30	1.28	-0.22	0.02	Step hazard
		1.37	1.35	-0.23	0.12	Slope hazard
		1.47	1.45	-0.23	0.22	Slope hazard
		1.67	1.65	-0.29	0.29	Slope hazard
		1.72	1.70	-0.29	0.31	Slope hazard
14	-7.02	1.30	1.29	-0.16	0.03	Step hazard
		1.37	1.36	-0.17	0.12	Slope hazard
		1.47	1.46	-0.18	0.22	Slope hazard
15	-4.22	1.30	1.30	-0.10	0.02	Step hazard
		1.37	1.37	-0.10	0.12	Slope hazard
		1.47	1.47	-0.11	0.22	Slope hazard
		1.67	1.67	-0.12	0.29	Slope hazard
16	-1.41	1.34	1.34	-0.03	0.09	Slope hazard
		1.37	1.37	-0.03	0.12	Slope hazard
		1.47	1.47	-0.04	0.22	Slope hazard
		1.59	1.58	-0.04	0.28	Slope hazard
17	1.40	1.34	1.34	0.03	0.09	Slope hazard
		1.37	1.37	0.03	0.12	Slope hazard
		1.47	1.47	0.04	0.22	Slope hazard
		1.63	1.63	0.04	0.34	Slope hazard
18	4.21	1.34	1.34	0.10	0.09	Slope hazard
		1.37	1.37	0.10	0.12	Slope hazard
		1.47	1.47	0.11	0.22	Slope hazard
		1.63	1.63	0.12	0.34	Slope hazard
19	7.02	1.20	1.19	0.15	-0.04	Step hazard
		1.34	1.33	0.16	0.09	Slope hazard
		1.37	1.36	0.17	0.12	Slope hazard
		1.47	1.46	0.18	0.22	Slope hazard
		1.59	1.57	0.19	0.28	Slope hazard
		1.63	1.62	0.20	0.34	Slope hazard
20	9.83	1.34	1.32	0.23	0.09	Slope hazard
		1.37	1.35	0.23	0.12	Slope hazard
		1.47	1.43	0.23	0.22	Slope hazard
		1.54	1.51	0.26	0.22	Step hazard
21	12.64	1.42	1.38	0.31	0.11	Step hazard
		1.63	1.59	0.36	0.33	Slope hazard
22	15.45	1.42	1.37	0.38	0.11	Step hazard
		1.63	1.57	0.43	0.33	Slope hazard
23	18.26	1.30	1.24	0.41	0.02	Step hazard
		1.47	1.40	0.46	0.22	Slope hazard
		1.60	1.51	0.50	0.23	Step hazard
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

7.2.2.5 B=0.90; Slope Threshold=25

Input file: MDL.SLOPE.05.25.90
File Creation Date : THU, AUG 11 1983   System time   20:27:16

```
            **  MODEL1 PARAMETERS  **
        HEIGHT FILTER COEFFICIENT =        0.25
        SLOPE FILTER COEFFICIENT  =        0.90
        LEVEL GROUND STEP THRESHOLD =      0.25 METERS
        SLOPE THRESHOLD =                 25.00 DEGREES
```
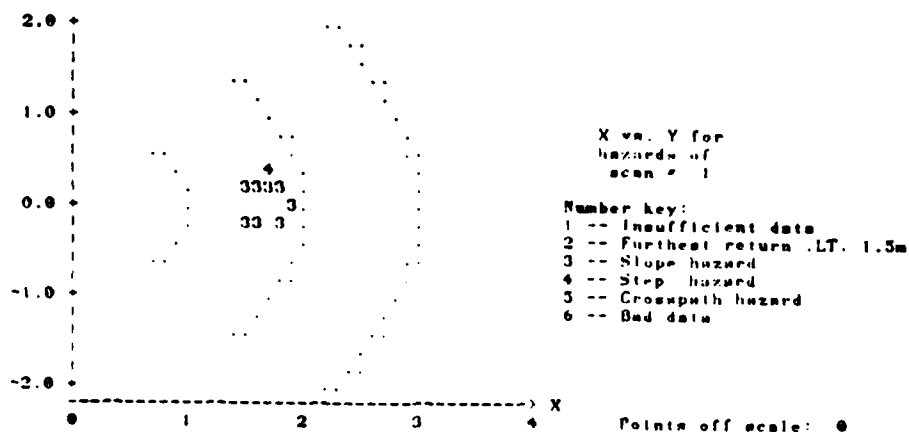
```
 2.0 .
     .                        ..
     .                     ..          .
 1.0 .                   ..              .
     .                .                  .         X vs. Y for
     .             ..                     .        hazards of
 0.0 .             .                      .          scan #  1
     .             ..                    .
     .                .                  .          Number key:
     .                  ..              .           1 -- Insufficient data
-1.0 .                   ..            .            2 -- Furthest return .LT. 1.5m
     .                     ..        ..             3 -- Slope hazard
     .                        ..                    4 -- Step  hazard
     .                         ..                   5 -- Crosspath hazard
-2.0 .                                              6 -- Bad data
     --------------------------------------> X
     0       1       2       3       4         Points off scale:  0
```

NO HAZARDS CATALOGED THIS SCAN

Input file: MDL.SLOPE.10.25.90
File Creation Date : THU, AUG 11 1983   System time   20:27:49

```
            **  MODEL1 PARAMETERS  **
        HEIGHT FILTER COEFFICIENT =        0.25
        SLOPE FILTER COEFFICIENT  =        0.90
        LEVEL GROUND STEP THRESHOLD =      0.25 METERS
        SLOPE THRESHOLD =                 25.00 DEGREES
```

```
 2.0 .
     .                        ..
     .                  ..          ..
 1.0 .              ..                 .         X vs. Y for
     .           ..                     .        hazards of
     .         .                         .          scan #  1
 0.0 .         .                         .
     .         .                         .          Number key:
     .          ..                      .           1 -- Insufficient data
     .            ..                    .           2 -- Furthest return .LT. 1.5m
-1.0 .              ..                ..            3 -- Slope hazard
     .                 ..          ..               4 -- Step  hazard
     .                    ..    ..                  5 -- Crosspath hazard
     .                      ..                      6 -- Bad data
-2.0 .                       ..
     --------------------------------------> X
     0       1       2       3       4         Points off scale:  0
```

NO HAZARDS CATALOGED THIS SCAN

Input file: MDL.SLOPE.15.25.90
File Creation Date : THU, AUG 11 1983   System time   20:28:17

** MODEL1 PARAMETERS **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT   =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   25.00 DEGREES

X vs. Y for
hazards of
  scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	N O	H A Z A R D S	C A T A L O G E D		
16	-1.41	N O	H A Z A R D S	C A T A L O G E D		
17	1.40	N O	H A Z A R D S	C A T A L O G E D		
18	4.21	N O	H A Z A R D S	C A T A L O G E D		
19	7.02	N O	H A Z A R D S	C A T A L O G E D		
20	9.83	N O	H A Z A R D S	C A T A L O G E D		
21	12.64	2.25	2.20	0.49	-0.04	Crosspath hazard
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.SLOPE.20.25.90
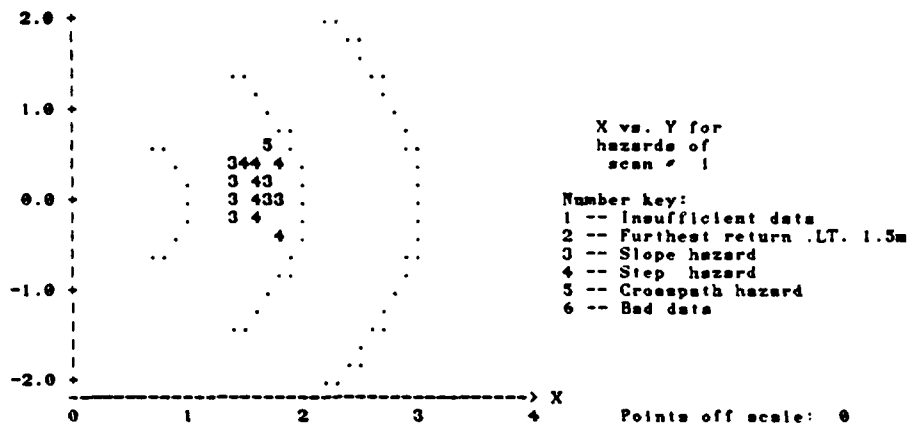File Creation Date : THU, AUG 11 1983   System time   20:28:45

```
            **  MODEL1 PARAMETERS   **
      HEIGHT FILTER COEFFICIENT =       0.25
      SLOPE FILTER COEFFICIENT  =       0.90
      LEVEL GROUND STEP THRESHOLD =     0.25 METERS
      SLOPE THRESHOLD =                 25.00 DEGREES
```
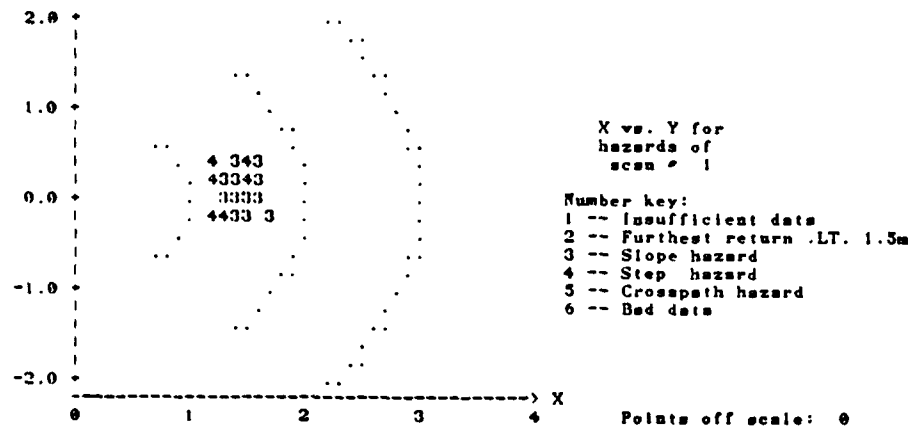
```
2.0 +                        . .
    I                          . .
    I
    I                  . .         . .
    I                    .
1.0 +                 .              .             X vs. Y for
    I                                              hazards of
    I              . .                                scan #  1
    I           .           4 5        .
    I                                  .          Number key:
0.0 +                        .         .          1 -- Insufficient data
    I                                  .          2 -- Furthest return .LT. 1.5m
    I                        .         .          3 -- Slope hazard
    I          . .           .        . .         4 -- Step  hazard
    I                       . .                   5 -- Crosspath hazard
-1.0 +         .              .                   6 -- Bad data
    I              . .           . .
    I
    I                 . .      . .
    I
    I                       . .
-2.0 +                    . .
    ---------------------------------------> X
    0         1         2         3         4      Points off scale:  0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	N O	H A Z A R D S	C A T A L O G E D		
16	-1.41	N O	H A Z A R D S	C A T A L O G E D		
17	1.40	N O	H A Z A R D S	C A T A L O G E D		
18	4.21	N O	H A Z A R D S	C A T A L O G E D		
19	7.02	N O	H A Z A R D S	C A T A L O G E D		
20	9.83	N O	H A Z A R D S	C A T A L O G E D		
21	12.64	2.04	1.99	0.45	-0.01	Step hazard
		2.25	2.20	0.49	-0.01	Crosspath hazard
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.SLOPE.25.25.90
File Creation Date : THU, AUG 11 1983   System time   20:29:06

**   MODEL1 PARAMETERS   **

HEIGHT FILTER COEFFICIENT =	0.25
SLOPE FILTER COEFFICIENT =	0.90
LEVEL GROUND STEP THRESHOLD =	0.25 METERS
SLOPE THRESHOLD =	25.00 DEGREES

```
 2.0 +
     |                          . .
     |                             . .
     |
     |                    . .
 1.0 +                             .        .
     |
     |                           . .
     |        . .                              . .
     |                   4    .
     |                   4
 0.0 +                   4     .                  .
     |             .     .
     |                                            .
     |
     |        . .              .                . .
     |                          . .
-1.0 +              .   .              .
     |
     |
     |        . .              . .
     |
-2.0 +                          . .
     ---------------------------------------------> X
     0         1          2          3          4
```

X vs. Y for
hazards of
   scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	N O	H A Z A R D S	C A T A L O G E D		
16	-1.41	N O	H A Z A R D S	C A T A L O G E D		
17	1.40	1.84	1.84	0.05	0.12	Step hazard
18	4.21	1.72	1.71	0.13	0.00	Step hazard
19	7.02	N O	H A Z A R D S	C A T A L O G E D		
20	9.83	N O	H A Z A R D S	C A T A L O G E D		
21	12.64	N O	H A Z A R D S	C A T A L O G E D		
22	15.45	1.72	1.66	0.46	-0.01	Step hazard
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.SLOPE.30.25.90
File Creation Date : THU, AUG 11 1983   System time   20:31:17

**   MODEL1 PARAMETERS   **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
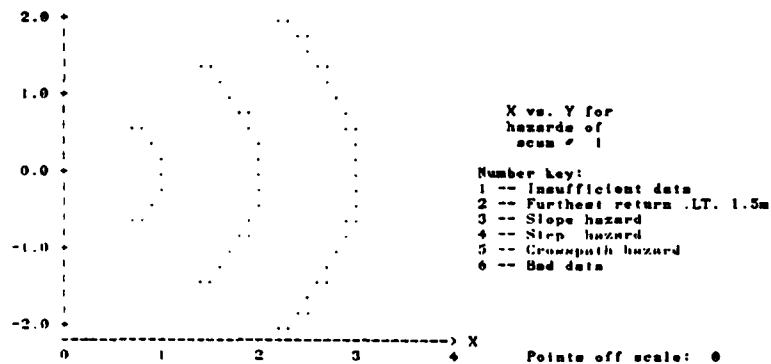SLOPE THRESHOLD =   25.00 DEGREES

X vs. Y for
hazards of
  scan 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S		C A T A L O G E D	
2	-40.74	N O	H A Z A R D S		C A T A L O G E D	
3	-37.93	N O	H A Z A R D S		C A T A L O G E D	
4	-35.13	N O	H A Z A R D S		C A T A L O G E D	
5	-32.31	N O	H A Z A R D S		C A T A L O G E D	
6	-29.50	N O	H A Z A R D S		C A T A L O G E D	
7	-26.69	N O	H A Z A R D S		C A T A L O G E D	
8	-23.88	N O	H A Z A R D S		C A T A L O G E D	
9	-21.08	N O	H A Z A R D S		C A T A L O G E D	
10	-18.26	N O	H A Z A R D S		C A T A L O G E D	
11	-15.45	N O	H A Z A R D S		C A T A L O G E D	
12	-12.64	N O	H A Z A R D S		C A T A L O G E D	
13	-9.84	1.84	1.81	-0.31	0.19	Step hazard
14	-7.02	1.61	1.60	-0.20	0.04	Step hazard
15	-4.22	N O	H A Z A R D S		C A T A L O G E D	
16	-1.41	1.61	1.61	-0.04	0.04	Step hazard
17	1.40	1.55	1.55	0.04	-0.00	Step hazard
		1.73	1.73	0.04	0.18	Step hazard
18	4.21	1.55	1.55	0.11	-0.00	Step hazard
19	7.02	N O	H A Z A R D S		C A T A L O G E D	
20	9.83	N O	H A Z A R D S		C A T A L O G E D	
21	12.64	N O	H A Z A R D S		C A T A L O G E D	
22	15.45	1.61	1.55	0.43	0.04	Step hazard
		1.82	1.76	0.49	0.15	Step hazard
23	18.26	1.55	1.47	0.49	-0.01	Step hazard
		1.75	1.66	0.55	-0.01	Crosspath hazard
24	21.07	N O	H A Z A R D S		C A T A L O G E D	
25	23.88	N O	H A Z A R D S		C A T A L O G E D	
26	26.69	N O	H A Z A R D S		C A T A L O G E D	
27	29.50	N O	H A Z A R D S		C A T A L O G E D	
28	32.31	N O	H A Z A R D S		C A T A L O G E D	
29	35.12	N O	H A Z A R D S		C A T A L O G E D	
30	37.93	N O	H A Z A R D S		C A T A L O G E D	
31	40.74	N O	H A Z A R D S		C A T A L O G E D	
32	43.55	N O	H A Z A R D S		C A T A L O G E D	

Input file: MDL.SLOPE.35.25.90
File Creation Date : THU, AUG 11 1983   System time   20:31:44
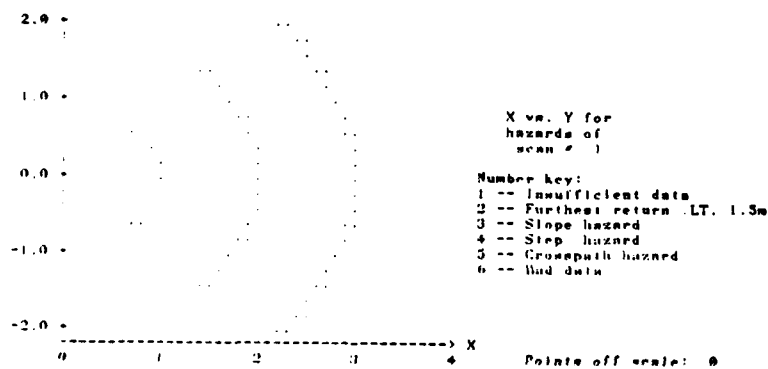
** MODEL1 PARAMETERS **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   25.00 DEGREES

```
2.0 +                              . .
    |                                . .
    |                            . .
    |                       . .            . .
    |                        .              .
1.0 +                                     .
    |                 . .                   .
    |            . .       4  5  .           . .
    |           . .                          .
    |              .    4  3  .              .
0.0 +            .  4     4  .               .
    |            .  4     4  .               .
    |              .       4  .              .
    |            . .              .          . .
    |              . .             .
-1.0 +                . .           .           . .
    |                   .            .
    |                 . .          . .
    |
-2.0 +                   . .
    ------------------------------------------> X
    0        1        2        3        4
```

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A ` A L O G E D		
5	-32.31	N O	H A Z A R D S	C A `. A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	1.23	1.21	-0.21	-0.11	Step hazard
		1.51	1.49	-0.26	0.07	Step hazard
		1.82	1.79	-0.31	0.27	Step hazard
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	1.51	1.51	-0.11	0.04	Step hazard
16	-1.41	1.23	1.23	-0.03	-0.10	Step hazard
17	1.40	1.63	1.62	0.04	0.23	Step hazard
18	4.21	1.72	1.72	0.13	0.30	Slope hazard
19	7.02	1.51	1.50	0.19	0.06	Step hazard
20	9.83	N O	H A Z A R D S	C A T A L O G E D		
21	12.64	N O	H A Z A R D S	C A T A L O G E D		
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	1.61	1.53	0.50	0.07	Step hazard
		1.75	1.66	0.55	0.07	Crosspath hazard
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

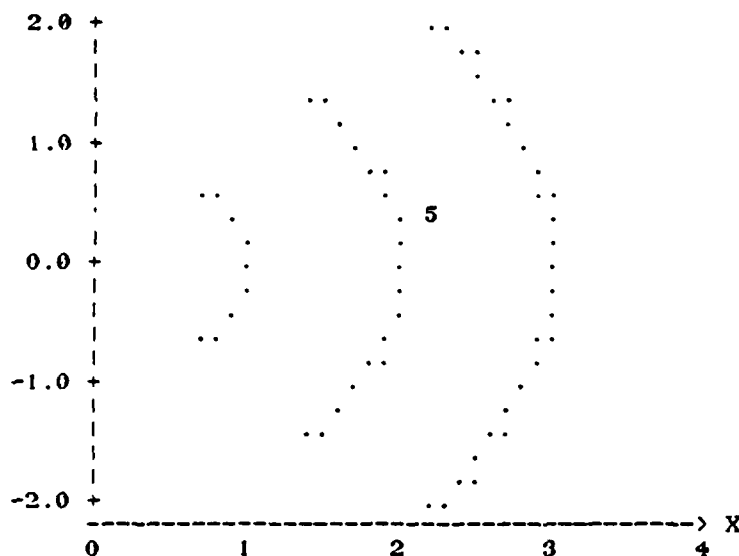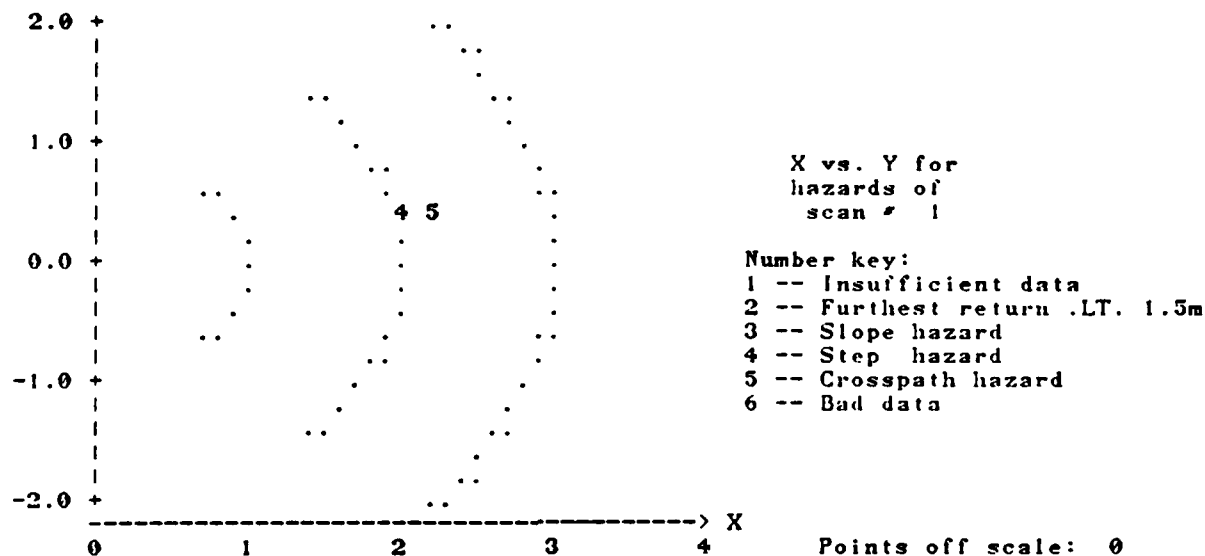Input file: MDL.SLOPE.40.25.90
File Creation Date : THU, AUG 11 1983   System time   20:32:12

** MODEL1 PARAMETERS **

HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
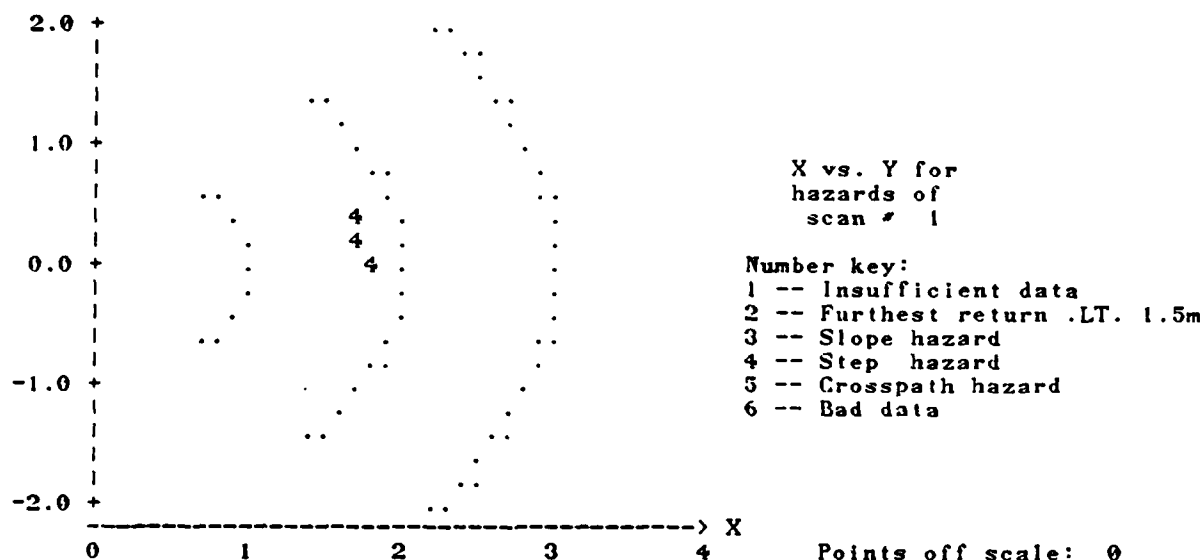SLOPE THRESHOLD =   25.00 DEGREES

```
2.0 +                        . .
    |
    |                    . .
    |
1.0 +                 .
    |              . .              .              X vs. Y for
    |                                              hazards of
    |           . .     4       .        .           scan #  1
    |                 443             .
0.0 +                 4           .                 Number key:
    |                 4               .             1 -- Insufficient data
    |                              .                2 -- Furthest return .LT. 1.5m
    |           . .                  . .            3 -- Slope hazard
    |                                               4 -- Step  hazard
-1.0 +               . .          .                 5 -- Crosspath hazard
    |                                               6 -- Bad data
    |              . .       . .
    |
    |                    . .
-2.0 +                 . .
    |
    ------------------------------------> X
    0        1        2        3        4           Points off scale:  0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	1.34	1.31	-0.29	0.07	Step hazard
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	N O	H A Z A R D S	C A T A L O G E D		
16	-1.41	1.42	1.42	-0.03	0.13	Step hazard
17	1.40	1.42	1.42	0.03	0.13	Step hazard
18	4.21	1.42	1.42	0.10	0.13	Step hazard
19	7.02	1.42	1.41	0.17	0.13	Step hazard
		1.63	1.62	0.20	0.34	Slope hazard
20	9.83	1.42	1.40	0.24	0.13	Step hazard
		1.54	1.51	0.26	0.22	Step hazard
21	12.64	N O	H A Z A R D S	C A T A L O G E D		
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	1.60	1.51	0.50	0.23	Step hazard
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

7.2.2.6 B=0.85; Slope Threshold=25

Input file: MDL.SLOPE.05.25.85
File Creation Date : THU. AUG 11 1983   System time   20:39:15

** MODEL1 PARAMETERS **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.85
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   25.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

NO HAZARDS CATALOGED THIS SCAN

Input file: MDL.SLOPE.10.25.85
File Creation Date : THU. AUG 11 1983   System time   20:39:53

** MODEL1 PARAMETERS **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.85
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   25.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

NO HAZARDS CATALOGED THIS SCAN

Input file: MDL.SLOPE.15.25.85
File Creation Date : THU, AUG 11 1983   System time   20:40:29

**   MODEL1 PARAMETERS   **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.85
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
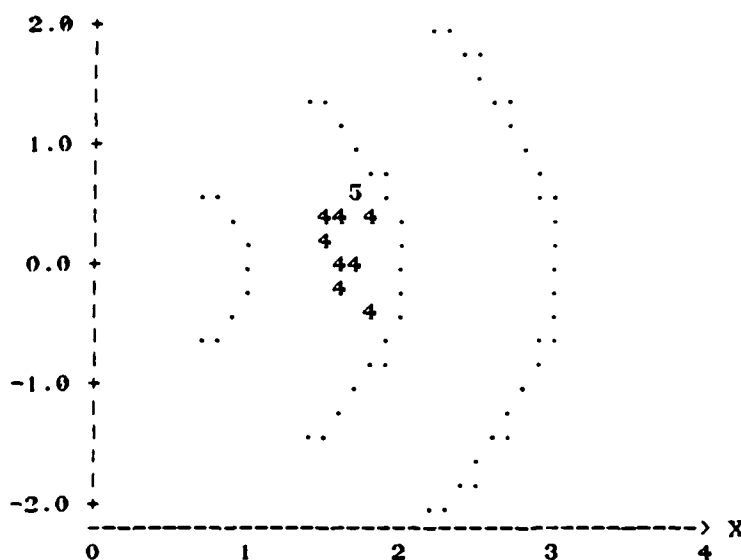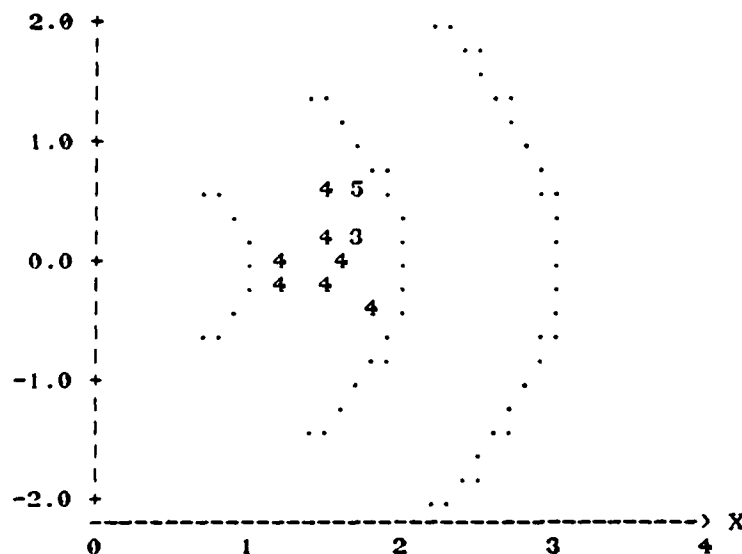SLOPE THRESHOLD =   25.00 DEGREES

```
  2.0 +                          . .
      |                              . .
      |                                .  .
      |                        . .       .  .
  1.0 +                      .              .
      |                   . .                 .        X vs. Y for
      |        . .                             .       hazards of
      |           .        4  .  5           .            scan #  1
      |                    4  .
  0.0 +                    4  .                .     Number key:
      |                    4  .                .     1 -- Insufficient data
      |              .                       .       2 -- Furthest return .LT. 1.5m
      |           . .                             .  3 -- Slope hazard
      |                                        .     4 -- Step  hazard
 -1.0 +              .                         .     5 -- Crosspath hazard
      |              . .                    .        6 -- Bad data
      |                  . .               .
      |                       .          .
 -2.0 +                          . .
      ------------------------------------------> X
      0        1        2        3        4         Points off scale:  0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	1.84	1.83	-0.13	-0.08	Step hazard
16	-1.41	1.84	1.84	-0.05	-0.08	Step hazard
17	1.40	1.84	1.84	0.05	-0.08	Step hazard
18	4.21	N O	H A Z A R D S	C A T A L O G E D		
19	7.02	1.84	1.82	0.22	-0.08	Step hazard
20	9.83	1.84	1.81	0.31	-0.08	Step hazard
21	12.64	2.25	2.20	0.49	-0.04	Crosspath hazard
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.SLOPE.20.25.85
File Creation Date : THU, AUG 11 1983   System time   20:41:19

```
             **  MODEL1 PARAMETERS  **
     HEIGHT FILTER COEFFICIENT =      0.25
     SLOPE FILTER COEFFICIENT  =      0.85
     LEVEL GROUND STEP THRESHOLD =    0.25 METERS
     SLOPE THRESHOLD =                25.00 DEGREES
```


X vs. Y for hazards of scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	N O	H A Z A R D S	C A T A L O G E D		
16	-1.41	1.51	1.51	-0.04	-0.15	Step hazard
		1.84	1.84	-0.05	-0.07	Step hazard
17	1.40	1.51	1.51	0.04	-0.14	Step hazard
18	4.21	1.53	1.53	0.11	-0.05	Slope hazard
19	7.02	1.51	1.50	0.18	-0.14	Step hazard
20	9.83	1.51	1.48	0.26	-0.15	Step hazard
		1.84	1.81	0.31	-0.07	Step hazard
21	12.64	1.84	1.79	0.40	-0.07	Step hazard
		2.04	1.99	0.45	-0.01	Step hazard
		2.25	2.20	0.49	-0.01	Crosspath hazard
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.SLOPE.25.25.85
File Creation Date : THU. AUG 11 1983   System time   20:41:44

**   MODELI PARAMETERS   **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.85
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   25.00 DEGREES

```
 2.0 +                        ..
     !                       ..   ..
     !                      ..       .
     !
 1.0 +                    ..            ..
     !                  .                  .      X vs. Y for
     !                .                      .    hazards of
     !              ..          4          ..        scan #  1
     !             .         33333.          .
 0.0 +             .           33.           .   Number key:
     !             .            3            .   1 -- Insufficient data
     !              .                       ..   2 -- Furthest return .LT. 1.5m
     !              ..                     ..    3 -- Slope hazard
     !                .                   .      4 -- Step  hazard
-1.0 +                 ..               ..       5 -- Crosspath hazard
     !                   .            ..         6 -- Bad data
     !                    ..        ..
     !                      ..    ..
-2.0 +                        ..
     ----------------------------------------> X
       0      .      1          2          3          4      Points off scale:  0
```
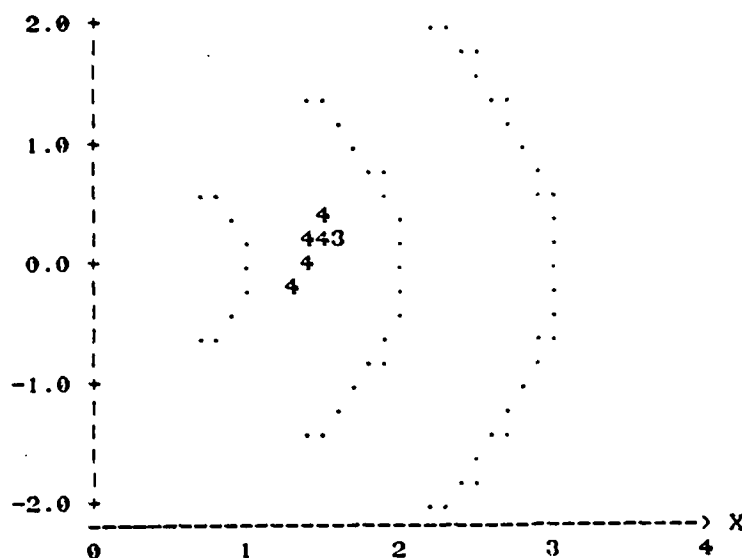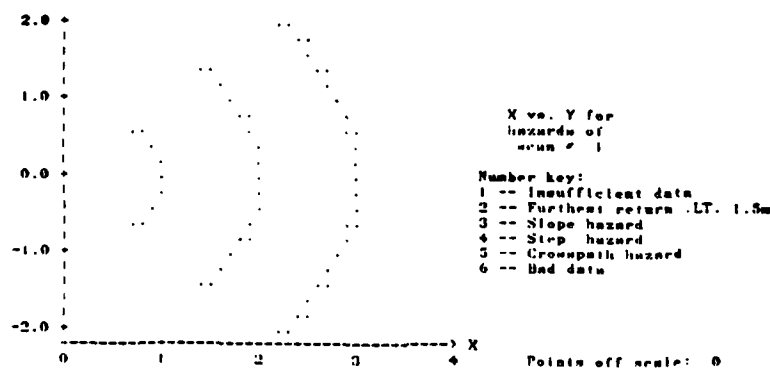
AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.43	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	1.76	1.76	-0.13	0.07	Slope hazard
		1.84	1.83	-0.14	0.11	Slope hazard
16	-1.41	1.84	1.84	-0.05	0.12	Slope hazard
17	1.40	1.93	1.93	0.05	0.19	Slope hazard
18	4.21	1.53	1.53	0.11	-0.05	Slope hazard
		1.76	1.76	0.13	0.07	Slope hazard
		1.84	1.83	0.14	0.11	Slope hazard
		1.93	1.94	0.14	0.14	Slope hazard
19	7.02	1.53	1.52	0.19	-0.05	Slope hazard
		1.58	1.57	0.19	-0.15	Step hazard
		1.65	1.64	0.20	0.00	Slope hazard
		1.76	1.73	0.22	0.07	Slope hazard
		1.84	1.82	0.22	0.11	Slope hazard
		1.95	1.93	0.24	0.14	Slope hazard
20	9.83	N O	H A Z A R D S	C A T A L O G E D		
21	12.64	N O	H A Z A R D S	C A T A L O G E D		
22	13.43	1.72	1.66	0.46	-0.01	Step hazard
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.SLOPE.30.25.85
File Creation Date : THU. AUG 11 1983   System time   20:42:12

```
          ** MODEL1 PARAMETERS  **
   HEIGHT FILTER COEFFICIENT =        0.25
   SLOPE FILTER COEFFICIENT  =        0.85
   LEVEL GROUND STEP THRESHOLD =      0.25 METERS
   SLOPE THRESHOLD =                 25.00 DEGREES
```
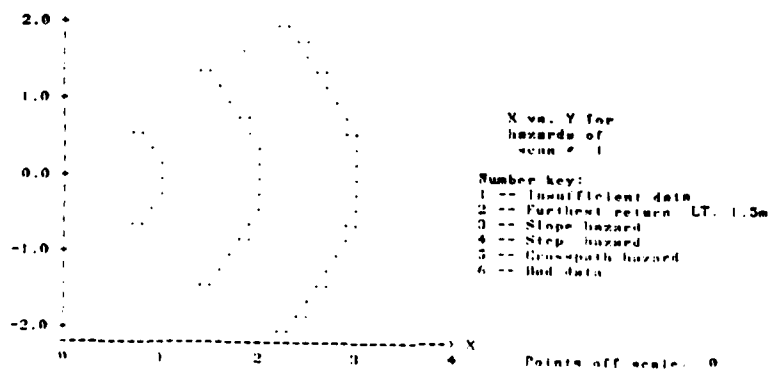
```
2.0 +                      . .
    |                        . .
    |
    |                  . .           .
1.0 +                    .       .
    |                             .
    |            . .      5  .          . .
    |              . 4444 4 .        . .
    |                4  43 .
0.0 +              .  4  433  .            .
    |                4  4  .
    |            . .      4  .        . .
    |                .
-1.0 +                  . .        .
    |                            .
    |                  . .    .
    |
-2.0 +                    . .
    |
    -----------------------------------------> X
    0        1        2        3        4
```

```
                                    X vs. Y for
                                    hazards of
                                      scan #  1

                                    Number key:
                                    1 -- Insufficient data
                                    2 -- Furthest return .LT. 1.5m
                                    3 -- Slope hazard
                                    4 -- Step  hazard
                                    5 -- Crosspath hazard
                                    6 -- Bad data
```

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.30	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.09	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	1.40	1.38	-0.24	-0.06	Step hazard
		1.84	1.81	-0.31	0.19	Step hazard
14	-7.02	1.40	1.39	-0.17	-0.06	Step hazard
		1.61	1.60	-0.20	0.04	Step hazard
15	-4.22	1.40	1.40	-0.10	-0.06	Step hazard
		1.60	1.59	-0.12	0.00	Step hazard
16	-1.41	1.40	1.40	-0.03	-0.06	Step hazard
		1.61	1.61	-0.04	0.04	Step hazard
17	1.40	1.40	1.40	0.03	-0.06	Step hazard
		1.66	1.66	0.04	0.13	Slope hazard
		1.73	1.73	0.04	0.18	Slope hazard
		1.82	1.82	0.04	0.25	Slope hazard
18	4.21	1.40	1.40	0.10	-0.06	Step hazard
		1.66	1.65	0.12	0.13	Slope hazard
		1.73	1.72	0.13	0.18	Slope hazard
19	7.02	1.40	1.39	0.17	-0.06	Step hazard
		1.60	1.59	0.20	0.00	Step hazard
20	9.83	1.40	1.38	0.24	-0.06	Step hazard
		1.60	1.57	0.27	0.00	Step hazard
21	12.64	1.40	1.37	0.31	-0.06	Step hazard
		1.50	1.56	0.35	0.00	Step hazard
22	15.45	1.40	1.35	0.37	-0.06	Step hazard
		1.82	1.76	0.49	0.15	Step hazard
23	18.26	1.55	1.47	0.49	-0.01	Step hazard
		1.73	1.66	0.55	-0.01	Crosspath hazard
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.30	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.SLOPE.35.25.85
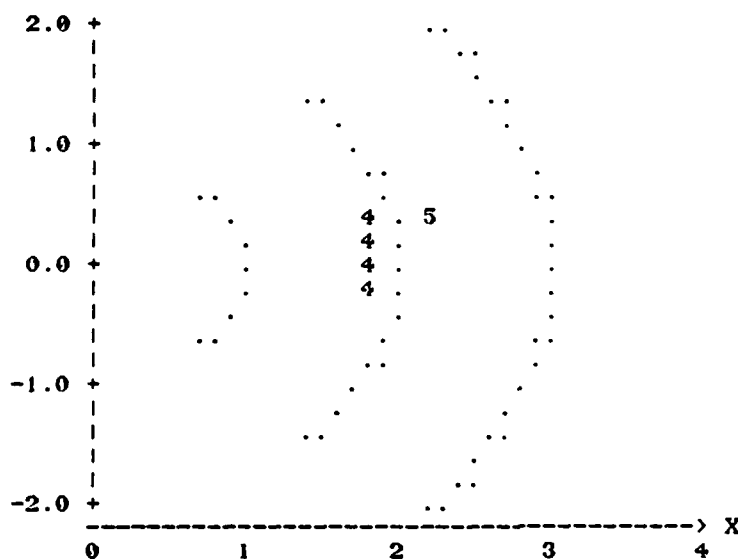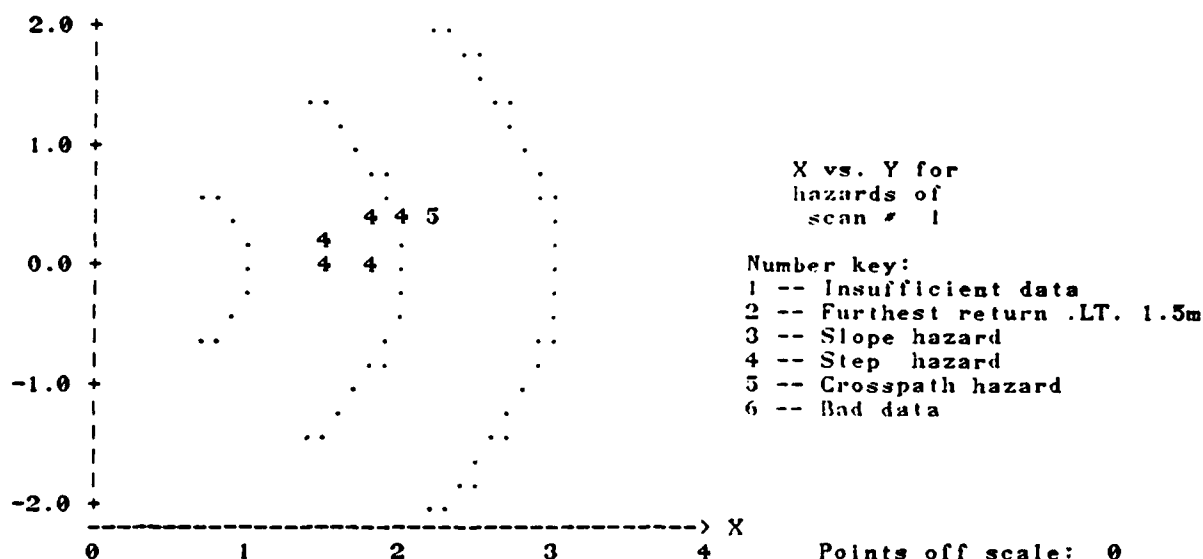File Creation Date : THU, AUG 11 1983   System time   20:42:48

```
              ** MODEL1 PARAMETERS **
     HEIGHT FILTER COEFFICIENT =        0.25
     SLOPE FILTER COEFFICIENT  =        0.85
     LEVEL GROUND STEP THRESHOLD =      0.25 METERS
     SLOPE THRESHOLD =                 25.00 DEGREES
```

```
 2.0 +                          . .
     !                             . .
     !                    . .           . .
     !
 1.0 +                  .                  .
     !          . .      4  5 .              . .
     !          .    . 4  3333 .               . .
 0.0 +          .      3   33 .                  .
     !          .      + 43 .                    .
     !            .      33 .                     .
     !                . .                      .
-1.0 +              . .                     .
     !                  . .               .
     !                    . .          . .
     !                       . .
-2.0 +                       . .
     -------------------------------------------> X
     0       1       2       3       4
```

X vs. Y for
hazards of
   scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	1.34	1.32	-0.23	0.07	Slope hazard
		1.56	1.54	-0.27	0.17	Slope hazard
		1.63	1.60	-0.28	0.18	Slope hazard
		1.77	1.75	-0.30	0.25	Slope hazard
		1.82	1.79	-0.31	0.27	Step hazard
		1.82	1.79	-0.31	0.27	Slope hazard
14	-7.02	1.30	1.29	-0.16	-0.06	Step hazard
		1.56	1.53	-0.19	0.17	Slope hazard
		1.63	1.61	-0.20	0.23	Slope hazard
15	-4.22	1.31	1.31	-0.11	0.04	Step hazard
16	-1.41	1.34	1.34	-0.03	0.07	Slope hazard
		1.56	1.56	-0.04	0.17	Slope hazard
		1.63	1.62	-0.04	0.23	Slope hazard
17	1.40	1.56	1.56	0.04	0.17	Slope hazard
		1.63	1.62	0.04	0.23	Slope hazard
		1.72	1.72	0.04	0.30	Slope hazard
18	4.21	1.51	1.51	0.11	0.12	Slope hazard
		1.56	1.56	0.11	0.18	Slope hazard
		1.63	1.62	0.12	0.23	Slope hazard
		1.72	1.72	0.13	0.30	Slope hazard
		1.82	1.82	0.13	0.28	Slope hazard
19	7.02	N O	H A Z A R D S	C A T A L O G E D		
20	9.83	1.17	1.16	0.20	-0.16	Step hazard
		1.26	1.24	0.21	0.01	Step hazard
		1.56	1.54	0.27	0.17	Slope hazard
		1.63	1.60	0.28	0.23	Slope hazard
21	12.64	N O	H A Z A R D S	C A T A L O G E D		
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	1.61	1.53	0.50	0.07	Step hazard
		1.75	1.66	0.55	0.07	Crosspath hazard
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

** MODEL1 PARAMETERS **
HEIGHT FILTER COEFFICIENT :   0.25
SLOPE FILTER COEFFICIENT :   0.85
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD   25.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.43	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	1.26	1.23	-0.28	-0.07	Step hazard
		1.34	1.31	-0.29	0.07	Step hazard
13	-9.84	1.47	1.43	-0.25	0.22	Slope hazard
		1.67	1.63	-0.29	0.29	Slope hazard
		1.72	1.70	-0.29	0.31	Slope hazard
14	-7.02	1.47	1.46	-0.18	0.22	Slope hazard
15	-4.22	1.47	1.47	-0.11	0.22	Slope hazard
		1.67	1.67	-0.12	0.29	Slope hazard
		1.72	1.72	-0.13	0.31	Slope hazard
16	-1.41	1.30	1.30	-0.03	0.03	Step hazard
		1.37	1.37	-0.03	0.12	Slope hazard
		1.47	1.47	-0.04	0.22	Slope hazard
		1.54	1.53	-0.04	0.23	Slope hazard
		1.59	1.58	-0.04	0.28	Slope hazard
		1.67	1.67	-0.04	0.30	Slope hazard
17	1.40	1.30	1.30	0.03	0.03	Step hazard
		1.37	1.37	0.03	0.12	Slope hazard
		1.47	1.47	0.04	0.22	Slope hazard
		1.53	1.53	0.04	0.26	Slope hazard
		1.59	1.58	0.04	0.29	Slope hazard
		1.63	1.63	0.04	0.34	Slope hazard
18	4.21	1.30	1.30	0.10	0.03	Step hazard
		1.37	1.37	0.10	0.12	Slope hazard
		1.47	1.47	0.11	0.22	Slope hazard
		1.53	1.53	0.11	0.26	Slope hazard
		1.59	1.58	0.12	0.29	Slope hazard
		1.63	1.63	0.12	0.34	Slope hazard
19	7.02	1.30	1.29	0.16	0.03	Step hazard
		1.37	1.36	0.17	0.12	Slope hazard
		1.47	1.46	0.18	0.22	Slope hazard
		1.59	1.57	0.19	0.28	Slope hazard
		1.63	1.62	0.20	0.34	Slope hazard
		1.72	1.71	0.21	0.32	Slope hazard
20	9.83	1.30	1.28	0.22	0.03	Step hazard
		1.37	1.35	0.23	0.12	Slope hazard
		1.47	1.45	0.25	0.22	Slope hazard
		1.54	1.51	0.26	0.22	Step hazard
21	12.64	1.54	1.50	0.34	0.23	Step hazard
22	15.43	1.54	1.48	0.41	0.23	Step hazard
23	18.26	1.37	1.31	0.43	0.11	Step hazard
		1.60	1.51	0.50	0.23	Step hazard
24	21.97	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.53	N O	H A Z A R D S	C A T A L O G E D		

7.2.2.7 B=0.80; Slope Threshold=25
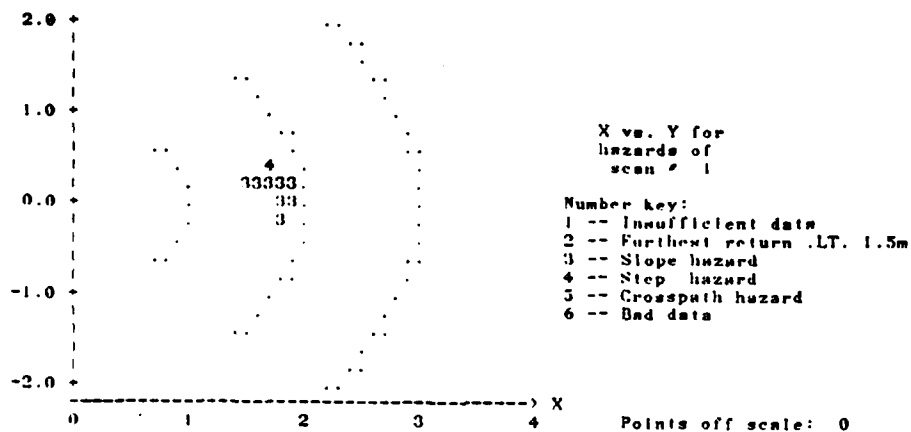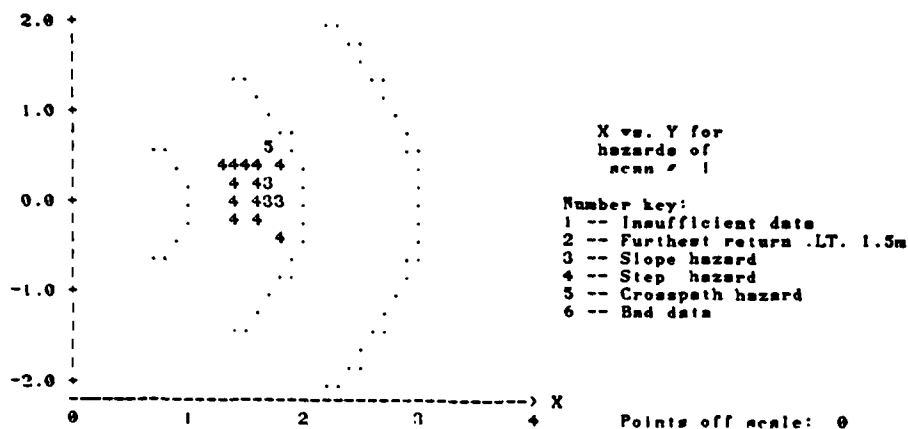
Input file: MDL.SLOPE.05.25.80
File Creation Date : THU, AUG 11 1983   System time   20:47:27

```
            **   MODEL1 PARAMETERS   **
        HEIGHT FILTER COEFFICIENT =        0.25
        SLOPE FILTER COEFFICIENT  =        0.80
        LEVEL GROUND STEP THRESHOLD =      0.25 METERS
        SLOPE THRESHOLD =                  25.00 DEGREES
```
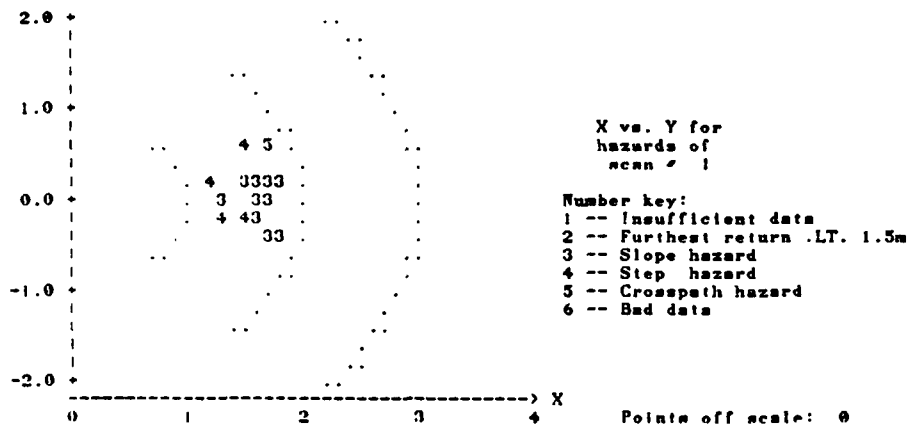


```
X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step  hazard
5 -- Crosspath hazard
6 -- Bad data
```

Points off scale: 0

NO HAZARDS CATALOGED THIS SCAN

Input file: MDL.SLOPE.10.25.80
File Creation Date : THU, AUG 11 1988   System time   20:48:06

**   MODEL1 PARAMETERS   **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.80
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   25.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data.
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

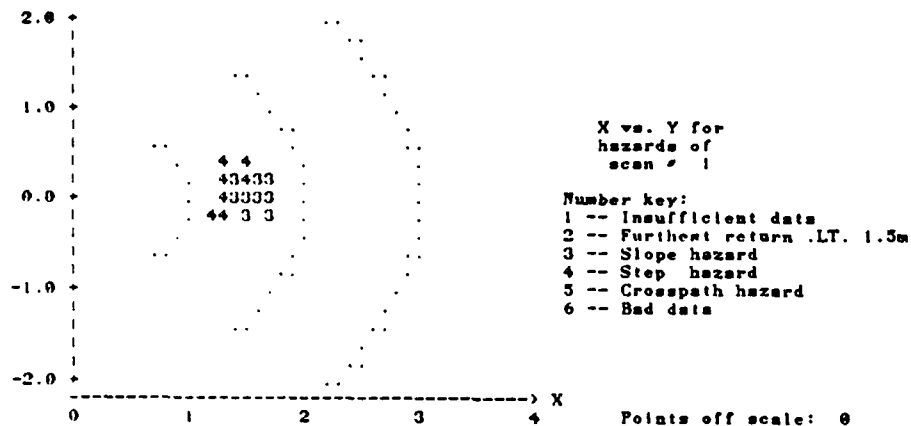| AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	1.97	1.96	-0.24	-0.17	Step hazard
15	-4.22	1.97	1.96	-0.14	-0.17	Step hazard
16	-1.41	1.97	1.97	-0.05	-0.17	Step hazard
17	1.40	1.97	1.97	0.05	-0.17	Step hazard
18	4.21	1.97	1.96	0.14	-0.17	Step hazard
19	7.02	1.97	1.96	0.24	-0.17	Step hazard
20	9.83	1.97	1.94	0.34	-0.17	Step hazard
21	12.64	1.97	1.92	0.43	-0.17	Step hazard
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.SLOPE.15.25.80
File Creation Date : THU, AUG 11 1983   System time   20:48:46

** MODEL1 PARAMETERS **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.80
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   25.00 DEGREES

```
2.0 +                    . .
    |                       . .
    |                        .
    |                 . .         . .
    |                  .            .
1.0 +                     . .
    |                                      X vs. Y for
    |             . .       . .    . .      hazards of
    |              .      3. 5      .        scan #  1
    |                     3.
0.0 +             .       3.    .           Number key:
    |          4          3.    .           1 -- Insufficient data
    |             . .            . .         2 -- Furthest return .LT. 1.5m
    |              .     . .      .           3 -- Slope hazard
    |                            .            4 -- Step  hazard
-1.0 +           .                 .          5 -- Crosspath hazard
    |             .            .              6 -- Bad data
    |           . .          . .
    |                     .
    |                    . .
-2.0 +                   . .
    ------------------------------------> X
    0       1       2       3       4      Points off scale:  0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	1.40	1.39	-0.17	-0.24	Step hazard
15	-4.22	1.88	1.87	-0.14	-0.01	Slope hazard
16	-1.41	1.88	1.88	-0.05	-0.01	Slope hazard
17	1.40	1.88	1.88	0.05	-0.01	Slope hazard
18	4.21	N O	H A Z A R D S	C A T A L O G E D		
19	7.02	1.88	1.87	0.23	-0.01	Slope hazard
20	9.83	1.88	1.85	0.32	-0.01	Slope hazard
21	12.64	2.25	2.20	0.49	-0.04	Crosspath hazard
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.SLOPE.20.25.80
File Creation Date : THU, AUG 11 1983   System time   20:59:22

```
              **  MODEL: PARAMETERS  **
          HEIGHT FILTER COEFFICIENT =      0.25
          SLOPE FILTER COEFFICIENT  =      0.80
          LEVEL GROUND STEP THRESHOLD =    0.25 METERS
          SLOPE THRESHOLD =                25.00 DEGREES
```



```
X vs. Y for
hazards of
 scan #  1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale:  0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	N O	H A Z A R D S	C A T A L O G E D		
16	-1.41	1.53	1.53	-0.04	-0.06	Slope hazard
		1.84	1.84	-0.05	-0.07	Step hazard
17	1.40	1.43	1.43	0.04	-0.12	Slope hazard
		1.53	1.53	0.04	-0.06	Slope hazard
		1.84	1.84	0.05	-0.07	Step hazard
		2.04	2.03	0.05	-0.01	Step hazard
18	4.21	1.43	1.43	0.11	-0.12	Slope hazard
		1.47	1.47	0.11	-0.10	Slope hazard
		1.53	1.53	0.11	-0.05	Slope hazard
		1.84	1.83	0.13	-0.07	Step hazard
19	7.02	1.53	1.52	0.19	-0.06	Slope hazard
20	9.83	1.53	1.51	0.26	-0.06	Slope hazard
		1.84	1.81	0.31	-0.07	Step hazard
21	12.64	1.84	1.79	0.40	-0.07	Step hazard
		2.04	1.99	0.45	-0.01	Step hazard
		2.25	2.20	0.49	-0.01	Crosspath hazard
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.SLOPE.25.25.80
File Creation Date : THU, AUG 11 1983   System time   20:51:23

```
                        **  MODEL1 PARAMETERS  **
              HEIGHT FILTER COEFFICIENT  =        0.25
              SLOPE FILTER COEFFICIENT   =        0.80
              LEVEL GROUND STEP THRESHOLD =       0.25 METERS
              SLOPE THRESHOLD =                  25.00 DEGREES
```

```
2.0 +                        ..
    I
    I                  ..                ..
    I
    I              ..                      ..
1.0 +
    I            .                          .         X vs. Y for
    I                                                 hazards of
    I           .            43 .            .          scan # 1
    I                   333333.
0.0 +          .         333.                .       Number key:
    I                  33333.                         1 -- Insufficient data
    I                                                 2 -- Furthest return .LT. 1.5m
    I           .                            .        3 -- Slope hazard
    I                                                 4 -- Step  hazard
-1.0 +            .                          .        5 -- Crosspath hazard
    I                                                 6 -- Bad data
    I              ..                      ..
    I
-2.0 +                  ..                ..
    I
    +------------------------------------> X
    0         1         2         3         4        Points off scale:  0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	1.76	1.73	-0.22	0.07	Slope hazard
		1.84	1.82	-0.22	0.11	Slope hazard
15	-4.22	1.53	1.53	-0.11	-0.05	Slope hazard
		1.58	1.58	-0.12	-0.15	Step hazard
		1.65	1.65	-0.12	0.00	Slope hazard
		1.76	1.76	-0.13	0.07	Slope hazard
		1.84	1.83	-0.14	0.11	Slope hazard
		1.95	1.94	-0.14	0.14	Slope hazard
16	-1.41	1.65	1.65	-0.04	0.01	Slope hazard
		1.76	1.76	-0.04	0.07	Slope hazard
		1.84	1.84	-0.05	0.12	Slope hazard
17	1.40	1.76	1.76	0.04	0.07	Slope hazard
		1.84	1.84	0.05	0.12	Slope hazard
		1.93	1.93	0.05	0.19	Slope hazard
18	4.21	1.43	1.43	0.11	-0.12	Slope hazard
		1.47	1.47	0.11	-0.10	Slope hazard
		1.53	1.53	0.11	-0.05	Slope hazard
		1.58	1.58	0.12	-0.03	Slope hazard
		1.62	1.61	0.12	-0.01	Slope hazard
		1.76	1.76	0.13	0.07	Slope hazard
		1.84	1.83	0.14	0.11	Slope hazard
		1.93	1.94	0.14	0.14	Slope hazard
19	7.02	1.43	1.42	0.18	-0.12	Slope hazard
		1.47	1.46	0.18	-0.10	Slope hazard
		1.53	1.52	0.19	-0.05	Slope hazard
		1.58	1.57	0.19	-0.15	Step hazard
		1.65	1.64	0.20	0.00	Slope hazard
		1.76	1.75	0.22	0.07	Slope hazard
		1.84	1.82	0.22	0.11	Slope hazard
		1.95	1.93	0.24	0.14	Slope hazard
20	9.83	1.76	1.74	0.30	0.07	Slope hazard
		1.84	1.81	0.31	0.11	Slope hazard
21	12.64	1.84	1.79	0.40	0.12	Slope hazard
22	15.45	1.72	1.66	0.46	-0.01	Step hazard
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.SLOPE.30.25.80
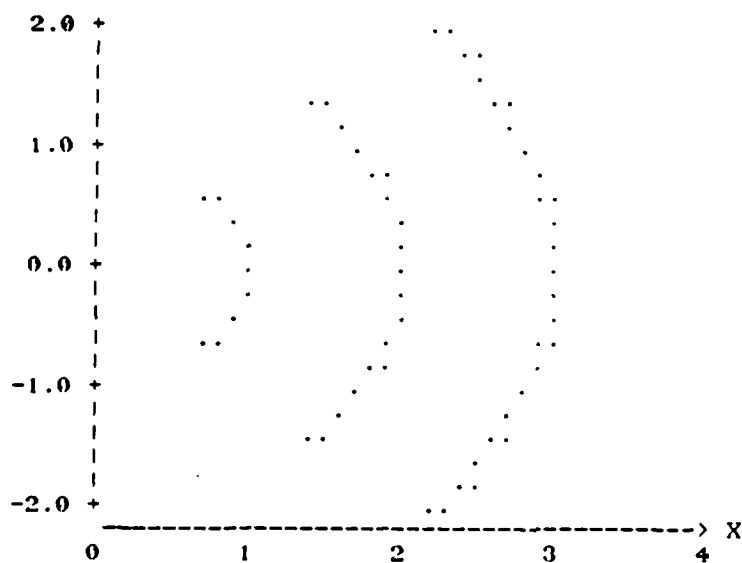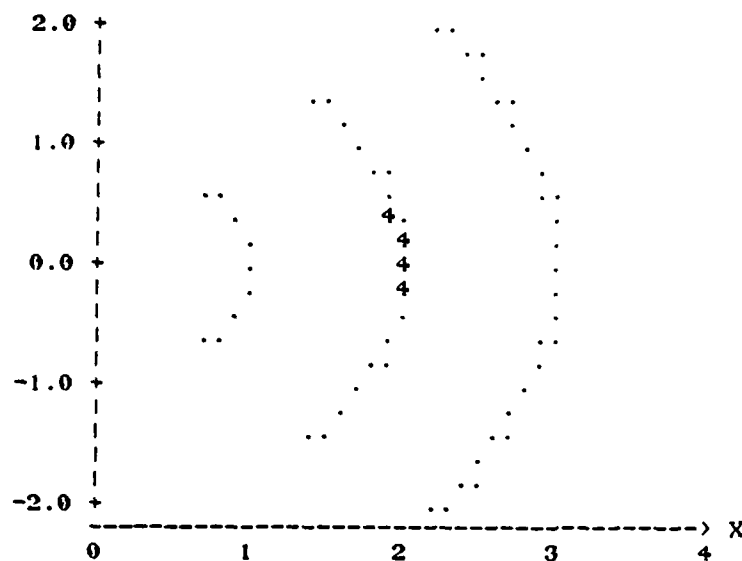File Creation Date : THU. AUG 11 1983   System time   20:52:05

```
          **  MODEL1 PARAMETERS  **
     HEIGHT FILTER COEFFICIENT  =        0.25
     SLOPE FILTER COEFFICIENT   =        0.80
     LEVEL GROUND STEP THRESHOLD =       0.25 METERS
     SLOPE THRESHOLD =                  25.00 DEGREES
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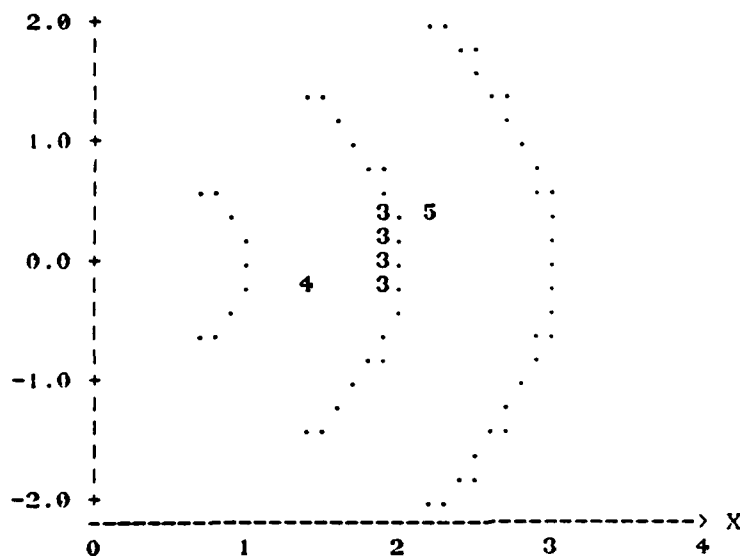

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

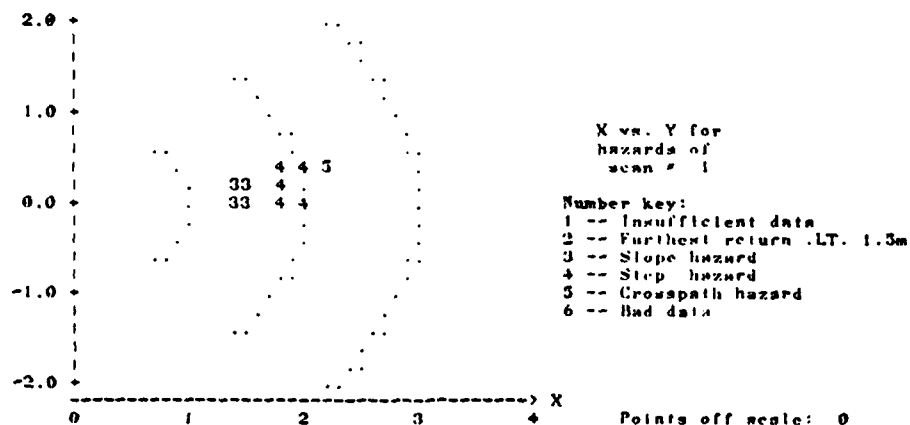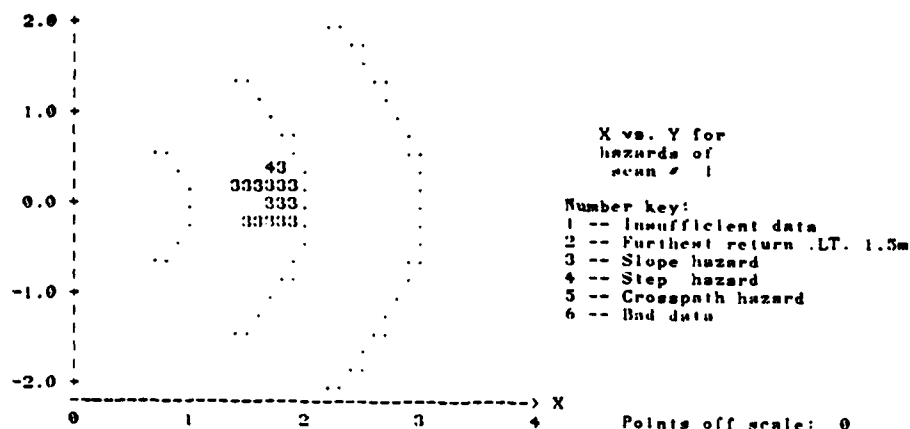| AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	1.43	1.41	-0.24	0.02	Slope hazard
		1.55	1.53	-0.27	0.05	Step hazard
		1.84	1.81	-0.31	0.19	Step hazard
14	-7.02	1.43	1.42	-0.18	0.02	Slope hazard
		1.61	1.60	-0.20	0.04	Step hazard
		1.73	1.71	-0.21	0.17	Slope hazard
15	-4.22	1.43	1.43	-0.11	0.02	Slope hazard
		1.60	1.59	-0.12	0.00	Step hazard
		1.73	1.72	-0.13	0.17	Slope hazard
16	-1.41	1.43	1.43	-0.04	0.02	Slope hazard
		1.61	1.61	-0.04	0.04	Step hazard
		1.73	1.73	-0.04	0.17	Slope hazard
17	1.40	1.43	1.43	0.04	0.02	Slope hazard
		1.66	1.66	0.04	0.13	Slope hazard
		1.73	1.73	0.04	0.18	Slope hazard
		1.82	1.82	0.04	0.25	Slope hazard
18	4.21	1.43	1.43	0.11	0.02	Slope hazard
		1.66	1.65	0.12	0.13	Slope hazard
		1.73	1.72	0.13	0.18	Slope hazard
		1.84	1.83	0.13	0.19	Slope hazard
19	7.02	1.43	1.42	0.18	0.02	Slope hazard
		1.60	1.59	0.20	0.00	Step hazard
		1.73	1.71	0.21	0.17	Slope hazard
20	9.83	1.43	1.41	0.24	0.02	Slope hazard
		1.60	1.57	0.27	0.00	Step hazard
		1.73	1.70	0.29	0.17	Slope hazard
21	12.64	1.43	1.40	0.31	0.02	Slope hazard
		1.60	1.56	0.35	0.00	Step hazard
		1.73	1.63	0.38	0.17	Slope hazard
22	15.45	1.43	1.38	0.38	0.02	Slope hazard
		1.61	1.55	0.43	0.04	Step hazard
		1.73	1.66	0.46	0.17	Slope hazard
		1.82	1.76	0.49	0.15	Step hazard
23	18.26	1.55	1.47	0.49	-0.01	Step hazard
		1.73	1.66	0.53	-0.01	Crosspath hazard
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.SLOPE.35.25.80
File Creation Date : THU, AUG 11 1983   System time   20:52:36

** MODEL1 PARAMETERS **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT   =   0.80
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   25.00 DEGREES

```
 2.0 .                         ..
     :
     :                    ..        ..
 1.0 .
     :              ..                  ..
     :             +  5  .
     :             3  33  .
     :           4333333 .
 0.0 .           . 3 3333 .
     :           . 3 33 3 .
     :              33
     :
     :                    ..        ..
-1.0 .
     :                    ..
     :
-2.0 .                     ..
     ----------------------------------------> X
     0        1        2        3        4
```

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N 0	H A Z A R D S	C A T A L O G E D		
2	-40.74	N 0	H A Z A R D S	C A T A L O G E D		
3	-37.93	N 0	H A Z A R D S	C A T A L O G E D		
4	-35.13	N 0	H A Z A R D S	C A T A L O G E D		
5	-32.31	N 0	H A Z A R D S	C A T A L O G E D		
6	-29.50	N 0	H A Z A R D S	C A T A L O G E D		
7	-26.69	N 0	H A Z A R D S	C A T A L O G E D		
8	-23.88	N 0	H A Z A R D S	C A T A L O G E D		
9	-21.08	N 0	H A Z A R D S	C A T A L O G E D		
10	-18.26	N 0	H A Z A R D S	C A T A L O G E D		
11	-15.45	N 0	H A Z A R D S	C A T A L O G E D		
12	-12.64	N 0	H A Z A R D S	C A T A L O G E D		
13	-9.84	1.34	1.32	-0.23	0.07	Slope hazard
		1.51	1.49	-0.26	0.07	Slope hazard
		1.56	1.54	-0.27	0.17	Slope hazard
		1.63	1.60	-0.28	0.18	Slope hazard
		1.77	1.73	-0.30	0.25	Slope hazard
		1.82	1.79	-0.31	0.27	Step hazard
		1.82	1.79	-0.31	0.27	Slope hazard
14	-7.02	1.34	1.33	-0.16	0.07	Slope hazard
		1.56	1.53	-0.19	0.17	Slope hazard
		1.63	1.61	-0.20	0.23	Slope hazard
		1.77	1.76	-0.22	0.25	Slope hazard
		1.82	1.81	-0.22	0.27	Slope hazard
15	-4.22	1.56	1.56	-0.11	0.16	Slope hazard
		1.63	1.62	-0.12	0.18	Slope hazard
		1.77	1.77	-0.11	0.25	Slope hazard
16	-1.41	1.34	1.34	-0.03	0.07	Slope hazard
		1.56	1.56	-0.04	0.17	Slope hazard
		1.63	1.62	-0.04	0.23	Slope hazard
		1.77	1.77	-0.04	0.25	Slope hazard
17	1.40	1.43	1.43	0.04	0.07	Slope hazard
		1.56	1.56	0.04	0.17	Slope hazard
		1.63	1.62	0.04	0.23	Slope hazard
		1.72	1.72	0.04	0.30	Slope hazard
18	4.21	1.45	1.45	0.11	0.07	Slope hazard
		1.51	1.51	0.11	0.12	Slope hazard
		1.56	1.56	0.11	0.18	Slope hazard
		1.63	1.62	0.12	0.23	Slope hazard
		1.72	1.72	0.13	0.30	Slope hazard
		1.82	1.82	0.13	0.28	Slope hazard
19	7.02	1.23	1.22	0.15	-0.10	Step hazard
		1.51	1.50	0.19	0.06	Step hazard
		1.63	1.61	0.20	0.23	Slope hazard
20	9.83	1.26	1.23	0.21	0.01	Slope hazard
		1.34	1.32	0.23	0.09	Slope hazard
		1.56	1.54	0.27	0.17	Slope hazard
		1.63	1.60	0.28	0.23	Slope hazard
		1.77	1.75	0.30	0.25	Slope hazard
		1.82	1.79	0.31	0.27	Slope hazard
21	12.64	1.20	1.17	0.26	-0.07	Step hazard
		1.51	1.48	0.33	0.07	Step hazard
22	15.45	1.56	1.50	0.42	0.17	Slope hazard
23	18.26	1.61	1.53	0.50	0.07	Step hazard
		1.75	1.66	0.53	0.07	Crosspath hazard
24	21.07	N 0	H A Z A R D S	C A T A L O G E D		
25	23.88	N 0	H A Z A R D S	C A T A L O G E D		
26	26.69	N 0	H A Z A R D S	C A T A L O G E D		
27	29.50	N 0	H A Z A R D S	C A T A L O G E D		
28	32.31	N 0	H A Z A R D S	C A T A L O G E D		
29	35.12	N 0	H A Z A R D S	C A T A L O G E D		
30	37.93	N 0	H A Z A R D S	C A T A L O G E D		
31	40.74	N 0	H A Z A R D S	C A T A L O G E D		
32	43.55	N 0	H A Z A R D S	C A T A L O G E D		

Input file: MDL.SLOPE.40.25.80
File Creation Date : THU. AUG 11 1983   System time   20:53:25

```
                    **  MODEL1 PARAMETERS  **
         HEIGHT FILTER COEFFICIENT  =          0.25
         SLOPE FILTER COEFFICIENT   =          0.80
         LEVEL GROUND STEP THRESHOLD =         0.25 METERS
         SLOPE THRESHOLD =                    25.00 DEGREES
```

165

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	1.26	1.23	-0.28	-0.07	Step hazard
		1.34	1.31	-0.29	0.07	Step hazard
13	-9.84	1.30	1.28	-0.22	0.02	Step hazard
		1.37	1.33	-0.23	0.12	Slope hazard
		1.47	1.43	-0.23	0.22	Slope hazard
		1.63	1.60	-0.28	0.24	Slope hazard
		1.67	1.63	-0.29	0.29	Slope hazard
		1.72	1.70	-0.29	0.31	Slope hazard
14	-7.02	1.30	1.29	-0.16	0.03	Step hazard
		1.37	1.36	-0.17	0.12	Slope hazard
		1.47	1.46	-0.18	0.22	Slope hazard
		1.54	1.52	-0.19	0.23	Slope hazard
		1.67	1.66	-0.20	0.29	Slope hazard
		1.72	1.71	-0.21	0.31	Slope hazard
15	-4.22	1.30	1.30	-0.10	0.02	Step hazard
		1.37	1.37	-0.10	0.12	Slope hazard
		1.47	1.47	-0.11	0.22	Slope hazard
		1.67	1.67	-0.12	0.29	Slope hazard
		1.72	1.72	-0.13	0.31	Slope hazard
16	-1.41	1.34	1.34	-0.03	0.09	Slope hazard
		1.37	1.37	-0.03	0.12	Slope hazard
		1.42	1.42	-0.03	0.13	Slope hazard
		1.47	1.47	-0.04	0.22	Slope hazard
		1.54	1.53	-0.04	0.23	Slope hazard
		1.59	1.58	-0.04	0.28	Slope hazard
		1.67	1.67	-0.04	0.30	Slope hazard
17	1.40	1.34	1.34	0.03	0.09	Slope hazard
		1.37	1.37	0.03	0.12	Slope hazard
		1.42	1.42	0.03	0.13	Slope hazard
		1.47	1.47	0.04	0.22	Slope hazard
		1.53	1.53	0.04	0.26	Slope hazard
		1.59	1.58	0.04	0.29	Slope hazard
		1.63	1.63	0.04	0.34	Slope hazard
18	4.21	1.34	1.34	0.10	0.09	Slope hazard
		1.37	1.37	0.10	0.12	Slope hazard
		1.42	1.42	0.10	0.13	Slope hazard
		1.47	1.47	0.11	0.22	Slope hazard
		1.53	1.53	0.11	0.26	Slope hazard
		1.59	1.58	0.12	0.29	Slope hazard
		1.63	1.63	0.12	0.34	Slope hazard
19	7.02	1.20	1.19	0.13	-0.04	Step hazard
		1.34	1.33	0.16	0.09	Slope hazard
		1.37	1.36	0.17	0.12	Slope hazard
		1.42	1.41	0.17	0.13	Slope hazard
		1.47	1.46	0.18	0.22	Slope hazard
		1.54	1.52	0.19	0.22	Slope hazard
		1.59	1.57	0.19	0.28	Slope hazard
		1.63	1.62	0.20	0.34	Slope hazard
		1.72	1.71	0.21	0.32	Slope hazard
20	9.83	1.34	1.32	0.23	0.09	Slope hazard
		1.37	1.35	0.23	0.12	Slope hazard
		1.42	1.40	0.24	0.13	Slope hazard
		1.47	1.45	0.25	0.22	Slope hazard
		1.54	1.51	0.26	0.22	Slope hazard
		1.67	1.63	0.29	0.29	Slope hazard
		1.72	1.70	0.29	0.31	Slope hazard
21	12.64	1.42	1.38	0.31	0.11	Step hazard
		1.63	1.59	0.36	0.33	Slope hazard
22	15.45	1.42	1.37	0.38	0.11	Step hazard
		1.63	1.57	0.43	0.33	Slope hazard
23	18.26	1.30	1.24	0.41	0.02	Step hazard
		1.47	1.40	0.46	0.22	Slope hazard
		1.60	1.51	0.50	0.23	Step hazard
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

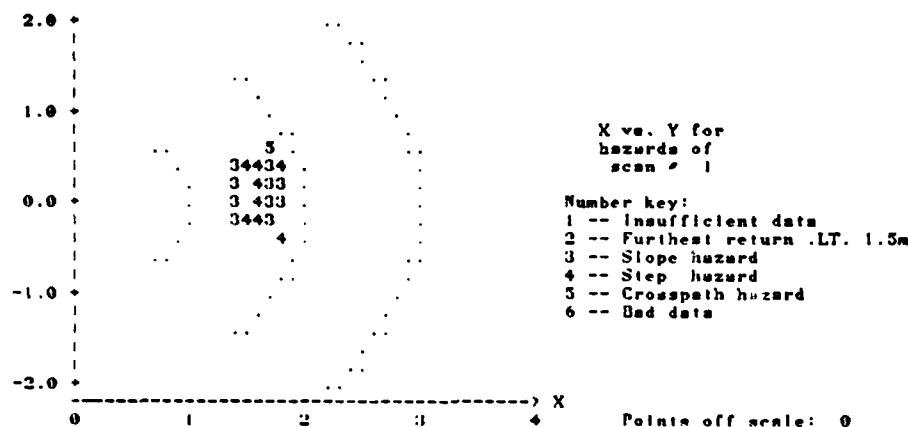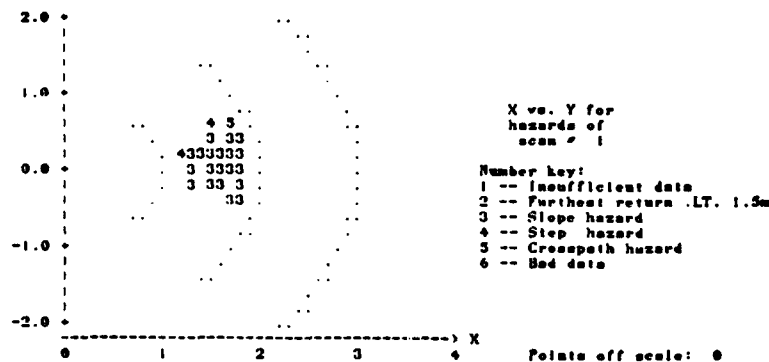## 7.2.2.8 B=0.75; Slope Threshold=25

Input file: MDL.SLOPE.05.25.75
File Creation Date : FRI, AUG 12 1983   System time   18:43:36

** MODEL1 PARAMETERS **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.75
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   25.00 DEGREES

```
2.0 +                          . .
    |                            . .
    |                              .
    |                       .        .
    |                   .              .
1.0 +                 .                  .
    |               .                      .
    |             . .                        .
    |          .                               .
    |       . .                        .4
0.0 +      .                           .4
    |      .             .               .
    |       .                              .
    |        .           .                .
    |       . .          .               .
-1.0+         .          .               .
    |          .         .             .
    |            .                    .
    |             . .               .
    |                 ,            .
-2.0+                    . .
    ------------------------------------------> X
    0        1        2        3        4
```

X vs. Y for
hazards of
   scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

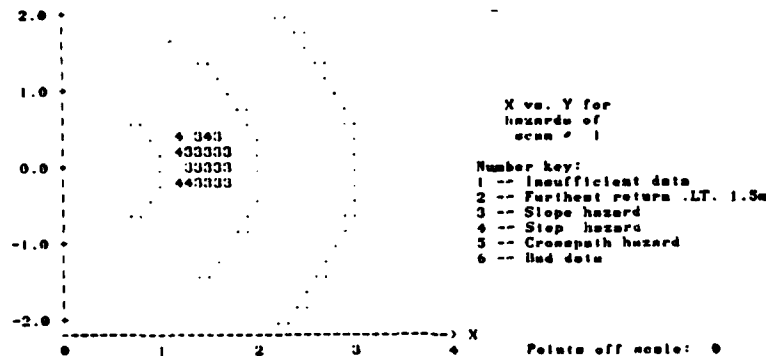| AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	N O	H A Z A R D S	C A T A L O G E D		
16	-1.41	N O	H A Z A R D S	C A T A L O G E D		
17	1.40	N O	H A Z A R D S	C A T A L O G E D		
18	4.21	N O	H A Z A R D S	C A T A L O G E D		
19	7.02	2.12	2.10	0.26	-0.25	Step hazard
20	9.83	2.12	2.09	0.36	-0.25	Step hazard
21	12.64	N O	H A Z A R D S	C A T A L O G E D		
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.SLOPE.10.25.75
File Creation Date : FRI. AUG 12 1983   System time   18:45:16

** MODEL1 PARAMETERS **

HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.75
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   25.00 DEGREES


```
 2.0 +                        ..
     I                          ..
     I                           .
     I                        ..         ..
 1.0 +
     I              .                  .       X vs. Y for
     I                 ..              .        hazards of
     I         ..         3        3    ..       scan #  1
 0.0 +           .        3        3    .      Number key:
     I                    3        3    .       1 -- Insufficient data
     I                                  .       2 -- Furthest return .LT. 1.5m
     I         ..                      .        3 -- Slope hazard
     I              ..              .           4 -- Step  hazard
-1.0 +             .                 .          5 -- Crosspath hazard
     I                ..           .            6 -- Bad data
     I               .              .
     I
-2.0 +                   ..
     ------------------------------------> X
     0        1        2        3        4      Points off scale:  0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	1.64	1.63	-0.20	-0.13	Slope hazard
		2.01	2.00	-0.23	-0.08	Slope hazard
15	-4.22	2.01	2.00	-0.15	-0.08	Slope hazard
16	-1.41	2.01	2.01	-0.05	-0.08	Slope hazard
17	1.40	1.64	1.64	0.04	-0.13	Slope hazard
		2.01	2.01	0.05	-0.08	Slope hazard
18	4.21	1.64	1.64	0.12	-0.13	Slope hazard
		2.01	2.00	0.13	-0.08	Slope hazard
19	7.02	2.01	2.00	0.25	-0.09	Slope hazard
20	9.83	2.01	1.98	0.34	-0.09	Slope hazard
21	12.64	2.01	1.96	0.44	-0.08	Slope hazard
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.SLOPE.15.25.75
File Creation Date : FRI, AUG 12 1983   System time   18:46:01

** MODEL1 PARAMETERS **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT   =   0.75
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   25.00 DEGREES

```
2.0 +
    |                           . .
    |                         . .
1.0 +                       .
    |                     . .         .
    |                   . .               .      X vs. Y for
    |                 .          3. 5      .      hazards of
    |                            34               scan #  1
0.0 +                    .       3.        .
    |               .        3   3.        .      Number key:
    |                 .                    .      1 -- Insufficient data
    |               . .                    . .    2 -- Furthest return .LT. 1.5m
    |                     .         .              3 -- Slope hazard
-1.0 +                  .           .              4 -- Step  hazard
    |                 . .         . .              5 -- Crosspath hazard
    |               . .         . .                6 -- Bad data
    |             .
-2.0 +                   . .
    ------------------------------------------> X
    0         1         2         3         4      Points off scale:  0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S		C A T A L O G E D	
2	-40.74	N O	H A Z A R D S		C A T A L O G E D	
3	-37.93	N O	H A Z A R D S		C A T A L O G E D	
4	-35.13	N O	H A Z A R D S		C A T A L O G E D	
5	-32.31	N O	H A Z A R D S		C A T A L O G E D	
6	-29.50	N O	H A Z A R D S		C A T A L O G E D	
7	-26.69	N O	H A Z A R D S		C A T A L O G E D	
8	-23.88	N O	H A Z A R D S		C A T A L O G E D	
9	-21.08	N O	H A Z A R D S		C A T A L O G E D	
10	-18.26	N O	H A Z A R D S		C A T A L O G E D	
11	-15.45	N O	H A Z A R D S		C A T A L O G E D	
12	-12.64	N O	H A Z A R D S		C A T A L O G E D	
13	-9.84	N O	H A Z A R D S		C A T A L O G E D	
14	-7.02	1.46	1.45	-0.18	-0.17	Slope hazard
15	-4.22	1.88	1.87	-0.14	-0.01	Slope hazard
16	-1.41	1.88	1.88	-0.05	-0.01	Slope hazard
17	1.40	1.88	1.88	0.05	-0.01	Slope hazard
18	4.21	1.97	1.96	0.14	-0.14	Step hazard
19	7.02	1.88	1.87	0.23	-0.01	Slope hazard
20	9.83	1.88	1.85	0.32	-0.01	Slope hazard
21	12.64	2.25	2.20	0.49	-0.04	Crosspath hazard
22	15.45	N O	H A Z A R D S		C A T A L O G E D	
23	18.26	N O	H A Z A R D S		C A T A L O G E D	
24	21.07	N O	H A Z A R D S		C A T A L O G E D	
25	23.88	N O	H A Z A R D S		C A T A L O G E D	
26	26.69	N O	H A Z A R D S		C A T A L O G E D	
27	29.50	N O	H A Z A R D S		C A T A L O G E D	
28	32.31	N O	H A Z A R D S		C A T A L O G E D	
29	35.12	N O	H A Z A R D S		C A T A L O G E D	
30	37.93	N O	H A Z A R D S		C A T A L O G E D	
31	40.74	N O	H A Z A R D S		C A T A L O G E D	
32	43.55	N O	H A Z A R D S		C A T A L O G E D	

Input file: MDL.SLOPE.20.25.75
File Creation Date : FRI. AUG 12 1983   System time   18:46:32

** MODEL1 PARAMETERS **

HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.75
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   25.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

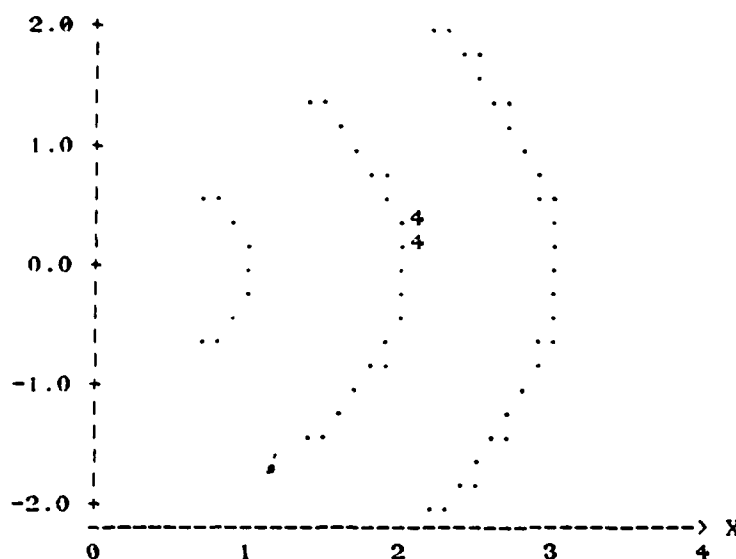| AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T	A L O G E D	
2	-40.74	N O	H A Z A R D S	C A T	A L O G E D	
3	-37.93	N O	H A Z A R D S	C A T	A L O G E D	
4	-35.13	N O	H A Z A R D S	C A T	A L O G E D	
5	-32.31	N O	H A Z A R D S	C A T	A L O G E D	
6	-29.50	N O	H A Z A R D S	C A T	A L O G E D	
7	-26.69	N O	H A Z A R D S	C A T	A L O G E D	
8	-23.88	N O	H A Z A R D S	C A T	A L O G E D	
9	-21.08	N O	H A Z A R D S	C A T	A L O G E D	
10	-18.26	N O	H A Z A R D S	C A T	A L O G E D	
11	-15.45	N O	H A Z A R D S	C A T	A L O G E D	
12	-12.64	N O	H A Z A R D S	C A T	A L O G E D	
13	-9.84	N O	H A Z A R D S	C A T	A L O G E D	
14	-7.02	1.84	1.82	-0.22	-0.07	Step hazard
15	-4.22	N O	H A Z A R D S	C A T	A L O G E D	
16	-1.41	1.40	1.40	-0.03	-0.14	Slope hazard
		1.53	1.53	-0.04	-0.06	Slope hazard
		1.88	1.88	-0.05	-0.00	Slope hazard
		1.96	1.96	-0.05	0.05	Slope hazard
17	1.40	1.40	1.40	0.03	-0.14	Slope hazard
		1.43	1.43	0.04	-0.12	Slope hazard
		1.53	1.53	0.04	-0.06	Slope hazard
		1.84	1.84	0.05	-0.07	Step hazard
		2.04	2.03	0.05	-0.01	Step hazard
18	4.21	1.40	1.39	0.10	-0.14	Slope hazard
		1.43	1.43	0.11	-0.12	Slope hazard
		1.47	1.47	0.11	-0.10	Slope hazard
		1.53	1.53	0.11	-0.05	Slope hazard
		1.84	1.83	0.13	-0.07	Step hazard
19	7.02	1.53	1.52	0.19	-0.06	Slope hazard
		1.84	1.82	0.22	-0.07	Step hazard
20	9.83	1.40	1.33	0.24	-0.14	Slope hazard
		1.53	1.51	0.26	-0.06	Slope hazard
		1.88	1.83	0.32	-0.00	Slope hazard
		1.96	1.93	0.34	0.05	Slope hazard
21	12.64	1.88	1.83	0.41	-0.00	Slope hazard
		2.04	1.99	0.43	-0.01	Step hazard
		2.25	2.20	0.49	-0.01	Crosspath hazard
22	15.45	N O	H A Z A R D S	C A T	A L O G E D	
23	18.26	N O	H A Z A R D S	C A T	A L O G E D	
24	21.07	N O	H A Z A R D S	C A T	A L O G E D	
25	23.88	N O	H A Z A R D S	C A T	A L O G E D	
26	26.69	N O	H A Z A R D S	C A T	A L O G E D	
27	29.50	N O	H A Z A R D S	C A T	A L O G E D	
28	32.31	N O	H A Z A R D S	C A T	A L O G E D	
29	35.12	N O	H A Z A R D S	C A T	A L O G E D	
30	37.93	N O	H A Z A R D S	C A T	A L O G E D	
31	40.74	N O	H A Z A R D S	C A T	A L O G E D	
32	43.55	N O	H A Z A R D S	C A T	A L O G E D	

Input file: MDL.SLOPE.25.25.75
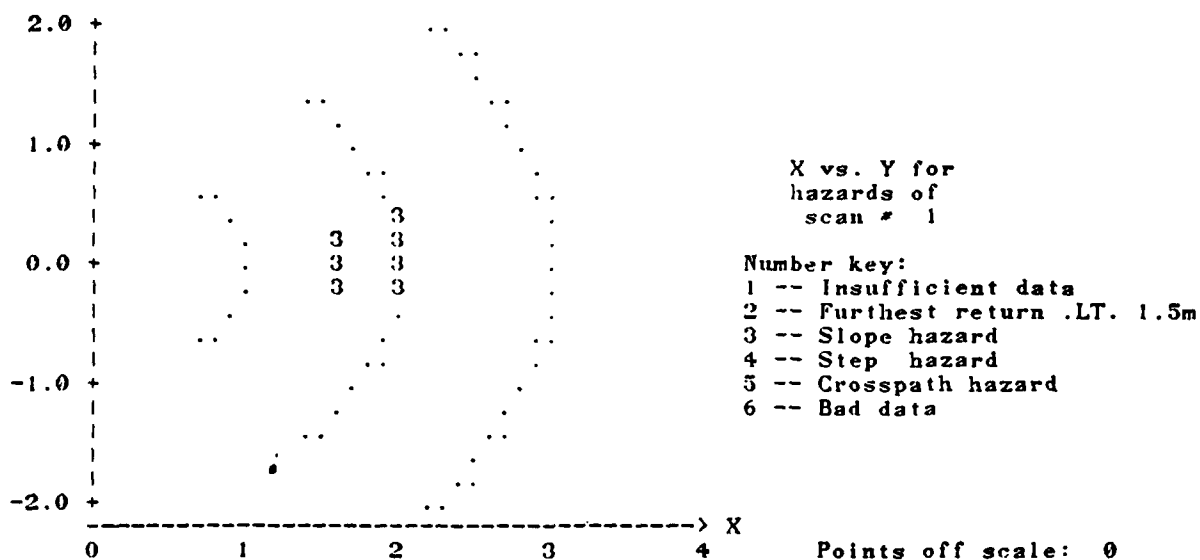File Creation Date : FRI. AUG 12 1983   System time   18:47:13

```
           ==  MODEL1 PARAMETERS  ==
     HEIGHT FILTER COEFFICIENT  =        0.25
     SLOPE FILTER COEFFICIENT  =         0.75
     LEVEL GROUND STEP THRESHOLD =       0.25 METERS
     SLOPE THRESHOLD =                   25.00 DEGREES
```


X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.54	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.06	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	1.33	1.33	-0.23	-0.07	Slope hazard
		1.76	1.74	-0.30	0.07	Slope hazard
14	-7.02	1.63	1.64	-0.20	0.00	Slope hazard
		1.76	1.75	-0.22	0.07	Slope hazard
		1.84	1.82	-0.22	0.11	Slope hazard
15	-4.22	1.43	1.43	-0.11	-0.12	Slope hazard
		1.47	1.47	-0.11	-0.10	Slope hazard
		1.53	1.53	-0.11	-0.03	Slope hazard
		1.58	1.58	-0.12	-0.15	Step hazard
		1.65	1.65	-0.12	0.00	Slope hazard
		1.76	1.74	-0.13	0.07	Slope hazard
		1.84	1.83	-0.14	0.11	Slope hazard
		1.93	1.94	-0.14	0.14	Slope hazard
16	-1.41	1.21	1.21	-0.03	-0.24	Step hazard
		1.30	1.30	-0.03	-0.13	Slope hazard
		1.53	1.53	-0.04	-0.05	Slope hazard
		1.65	1.65	-0.04	0.01	Slope hazard
		1.76	1.76	-0.04	0.07	Slope hazard
		1.84	1.84	-0.03	0.12	Slope hazard
17	1.40	1.52	1.52	0.03	-0.10	Slope hazard
		1.65	1.65	0.04	0.01	Slope hazard
		1.76	1.76	0.04	0.07	Slope hazard
		1.84	1.84	0.03	0.12	Slope hazard
		1.93	1.93	0.05	0.19	Slope hazard
18	4.21	1.39	1.39	0.10	-0.14	Slope hazard
		1.43	1.43	0.11	-0.12	Slope hazard
		1.47	1.47	0.11	-0.10	Slope hazard
		1.53	1.53	0.11	-0.05	Slope hazard
		1.58	1.58	0.12	-0.03	Slope hazard
		1.62	1.61	0.12	-0.01	Slope hazard
		1.76	1.76	0.13	0.07	Slope hazard
		1.84	1.83	0.14	0.11	Slope hazard
		1.93	1.94	0.14	0.14	Slope hazard
19	7.02	1.39	1.39	0.17	-0.14	Slope hazard
		1.43	1.42	0.18	-0.12	Slope hazard
		1.47	1.46	0.18	-0.10	Slope hazard
		1.53	1.52	0.19	-0.05	Slope hazard
		1.58	1.57	0.19	-0.13	Step hazard
		1.65	1.64	0.20	0.00	Slope hazard
		1.76	1.73	0.22	0.07	Slope hazard
		1.84	1.82	0.22	0.11	Slope hazard
		1.93	1.93	0.24	0.14	Slope hazard
20	9.83	1.63	1.63	0.28	0.00	Slope hazard
		1.76	1.74	0.30	0.07	Slope hazard
		1.84	1.81	0.31	0.11	Slope hazard
21	12.64	1.85	1.82	0.38	-0.07	Slope hazard
		1.76	1.72	0.39	0.07	Slope hazard
		1.84	1.79	0.40	0.12	Slope hazard
22	15.45	1.72	1.66	0.46	-0.01	Step hazard
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.SLOPE.30.25.75
File Creation Date : FRI. AUG 12 1983   System time   18:48:19

== MODEL1 PARAMETERS ==
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.75
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
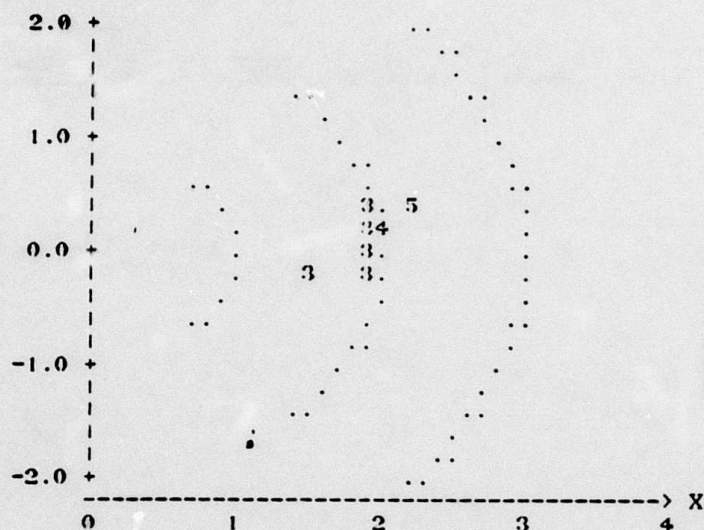SLOPE THRESHOLD =   25.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
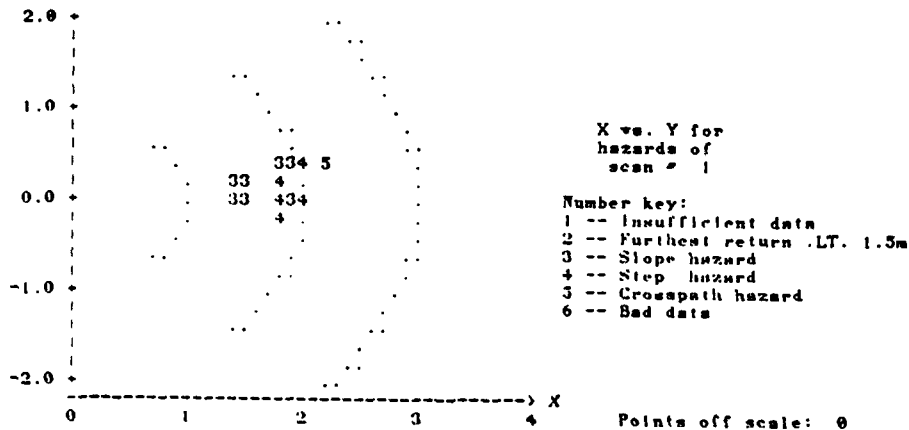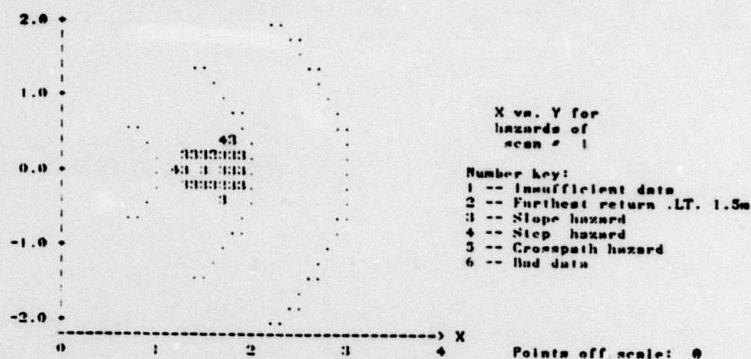5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O H A Z A R D S		C A T A L O G E D		
2	-40.74	N O H A Z A R D S		C A T A L O G E D		
3	-37.93	N O H A Z A R D S		C A T A L O G E D		
4	-35.13	N O H A Z A R D S		C A T A L O G E D		
5	-32.31	N O H A Z A R D S		C A T A L O G E D		
6	-29.50	N O H A Z A R D S		C A T A L O G E D		
7	-26.69	N O H A Z A R D S		C A T A L O G E D		
8	-23.88	N O H A Z A R D S		C A T A L O G E D		
9	-21.08	N O H A Z A R D S		C A T A L O G E D		
10	-18.26	N O H A Z A R D S		C A T A L O G E D		
11	-15.45	N O H A Z A R D S		C A T A L O G E D		
12	-12.64	N O H A Z A R D S		C A T A L O G E D		
13	-9.84	1.43	1.41	-0.24	0.02	Slope hazard
		1.53	1.53	-0.27	0.05	Step hazard
		1.73	1.70	-0.29	0.18	Slope hazard
		1.84	1.81	-0.31	0.19	Step hazard
14	-7.02	1.33	1.34	-0.17	-0.07	Slope hazard
		1.43	1.42	-0.18	0.02	Slope hazard
		1.66	1.64	-0.20	0.12	Slope hazard
		1.73	1.71	-0.21	0.17	Slope hazard
15	-4.22	1.35	1.35	-0.10	-0.07	Slope hazard
		1.43	1.43	-0.11	0.02	Slope hazard
		1.66	1.65	-0.12	0.11	Slope hazard
		1.73	1.72	-0.13	0.17	Slope hazard
16	-1.41	1.35	1.33	-0.03	-0.07	Slope hazard
		1.43	1.43	-0.04	0.02	Slope hazard
		1.66	1.66	-0.04	0.12	Slope hazard
		1.73	1.73	-0.04	0.17	Slope hazard
17	1.40	1.35	1.35	0.03	-0.07	Slope hazard
		1.43	1.43	0.04	0.02	Slope hazard
		1.66	1.66	0.04	0.13	Slope hazard
		1.73	1.73	0.04	0.18	Slope hazard
		1.82	1.82	0.04	0.23	Slope hazard
18	4.21	1.35	1.35	0.10	-0.07	Slope hazard
		1.43	1.43	0.11	0.02	Slope hazard
		1.66	1.65	0.12	0.13	Slope hazard
		1.73	1.72	0.13	0.18	Slope hazard
		1.84	1.83	0.13	0.19	Slope hazard
		1.88	1.87	0.14	0.21	Slope hazard
19	7.02	1.35	1.34	0.17	-0.07	Slope hazard
		1.43	1.42	0.18	0.02	Slope hazard
		1.66	1.64	0.20	0.11	Slope hazard
		1.73	1.71	0.21	0.17	Slope hazard
20	9.83	1.35	1.33	0.23	-0.07	Slope hazard
		1.43	1.41	0.24	0.02	Slope hazard
		1.66	1.63	0.28	0.11	Slope hazard
		1.73	1.70	0.29	0.17	Slope hazard
21	12.64	1.35	1.32	0.30	-0.07	Slope hazard
		1.43	1.40	0.31	0.02	Slope hazard
		1.66	1.62	0.36	0.11	Slope hazard
		1.73	1.68	0.38	0.17	Slope hazard
22	15.45	1.43	1.38	0.38	0.02	Slope hazard
		1.66	1.60	0.44	0.12	Slope hazard
		1.73	1.66	0.46	0.17	Slope hazard
		1.82	1.76	0.49	0.15	Step hazard
23	18.26	1.55	1.47	0.49	-0.01	Step hazard
		1.75	1.66	0.55	-0.01	Crosspath hazard
24	21.07	N O H A Z A R D S		C A T A L O G E D		
25	23.88	N O H A Z A R D S		C A T A L O G E D		
26	26.69	N O H A Z A R D S		C A T A L O G E D		
27	29.50	N O H A Z A R D S		C A T A L O G E D		
28	32.31	N O H A Z A R D S		C A T A L O G E D		
29	35.12	N O H A Z A R D S		C A T A L O G E D		
30	37.93	N O H A Z A R D S		C A T A L O G E D		
31	40.74	N O H A Z A R D S		C A T A L O G E D		
32	43.55	N O H A Z A R D S		C A T A L O G E D		

Input file: MDL.SLOPE.35.25.75
File Creation Date : FRI, AUG 12 1983   System time   18:48:59

== MODEL1 PARAMETERS ==

HEIGHT FILTER COEFFICIENT =	0.25
SLOPE FILTER COEFFICIENT =	-0.75
LEVEL GROUND STEP THRESHOLD =	0.25 METERS
SLOPE THRESHOLD =	25.00 DEGREES

X vs. Y for
hazards of
scan = 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	1.30	1.28	-0.22	-0.05	Slope hazard
		1.34	1.32	-0.23	0.07	Slope hazard
		1.51	1.49	-0.26	0.07	Slope hazard
		1.56	1.54	-0.27	0.17	Slope hazard
		1.63	1.69	-0.28	0.18	Slope hazard
		1.77	1.75	-0.30	0.25	Slope hazard
		1.82	1.79	-0.31	0.27	Step hazard
		1.82	1.79	-0.31	0.27	Slope hazard
14	-7.02	1.26	1.25	-0.15	-0.14	Step hazard
		1.34	1.33	-0.16	0.07	Slope hazard
		1.51	1.50	-0.19	0.07	Slope hazard
		1.56	1.55	-0.19	0.17	Slope hazard
		1.63	1.61	-0.20	0.23	Slope hazard
		1.77	1.76	-0.22	0.25	Slope hazard
		1.82	1.81	-0.22	0.27	Slope hazard
15	-4.22	1.26	1.25	-0.09	-0.14	Step hazard
		1.39	1.29	-0.10	-0.06	Step hazard
		1.56	1.56	-0.11	0.16	Slope hazard
		1.63	1.62	-0.12	0.18	Slope hazard
		1.77	1.77	-0.13	0.25	Slope hazard
		1.82	1.82	-0.13	0.27	Slope hazard
16	-1.41	1.30	1.30	-0.03	-0.05	Slope hazard
		1.34	1.34	-0.03	0.07	Slope hazard
		1.56	1.56	-0.04	0.17	Slope hazard
		1.63	1.62	-0.04	0.23	Slope hazard
		1.77	1.77	-0.04	0.25	Slope hazard
17	1.40	1.45	1.45	0.04	0.07	Slope hazard
		1.56	1.56	0.04	0.17	Slope hazard
		1.63	1.62	0.04	0.23	Slope hazard
		1.72	1.72	0.04	0.30	Slope hazard
18	4.21	1.45	1.45	0.11	0.07	Slope hazard
		1.51	1.51	0.11	0.12	Slope hazard
		1.56	1.56	0.11	0.18	Slope hazard
		1.63	1.62	0.12	0.23	Slope hazard
		1.72	1.72	0.13	0.30	Slope hazard
		1.82	1.82	0.13	0.28	Slope hazard
19	7.02	1.26	1.25	0.15	-0.07	Step hazard
		1.56	1.55	0.19	0.17	Slope hazard
		1.63	1.61	0.20	0.23	Slope hazard
		1.77	1.76	0.22	0.25	Slope hazard
20	9.83	1.17	1.16	0.20	-0.16	Step hazard
		1.26	1.24	0.21	0.01	Slope hazard
		1.34	1.32	0.23	0.09	Slope hazard
		1.56	1.54	0.27	0.17	Slope hazard
		1.63	1.60	0.28	0.23	Slope hazard
		1.77	1.73	0.30	0.25	Slope hazard
		1.82	1.79	0.31	0.27	Slope hazard
21	12.64	1.20	1.17	0.26	-0.07	Step hazard
		1.56	1.52	0.34	0.17	Slope hazard
		1.77	1.73	0.39	0.26	Slope hazard
22	15.45	1.34	1.29	0.36	0.09	Slope hazard
		1.56	1.50	0.42	0.17	Slope hazard
		1.77	1.71	0.47	0.25	Slope hazard
		1.82	1.76	0.49	0.27	Slope hazard
23	18.26	1.61	1.51	0.50	0.07	Step hazard
		1.73	1.66	0.55	0.07	Crosspath hazard
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	45.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	39.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.SLOPE.40.25.75
File Creation Date : FRI, AUG 12 1983   System time   18:50:01

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            **  MODEL1 PARAMETERS  **
HEIGHT FILTER COEFFICIENT •           0.25
SLOPE FILTER COEFFICIENT •            0.75
LEVEL GROUND STEP THRESHOLD •         0.25 METERS
SLOPE THRESHOLD •                    25.00 DEGREES
```
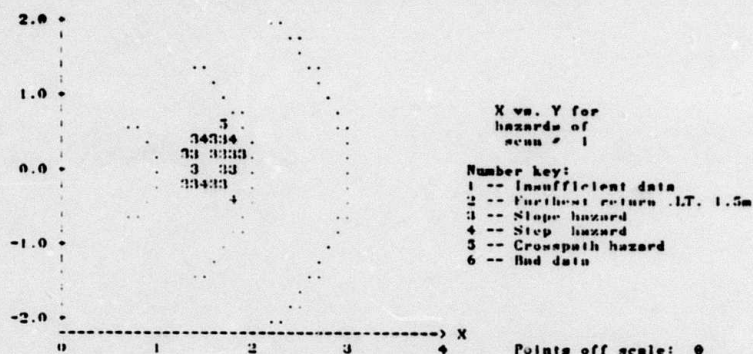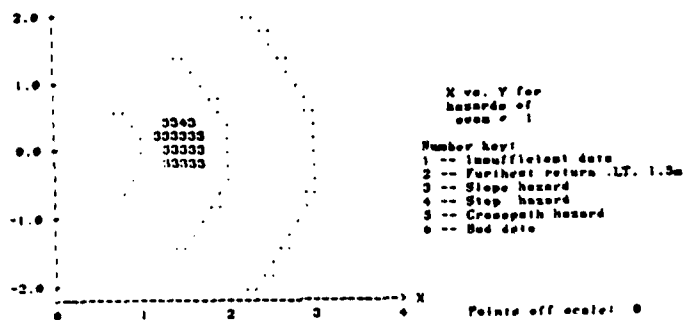
```
 2.0 .

 1.0 .                                              X vs. Y for
                                                    hazards of
                                                    even • 1
                  3343
 0.0 .          333333 .                            Number key:
                 33333  .                           1 -- insufficient data
                 33333  .                           2 -- Furthest return .LT. 1.5m
                                                    3 -- Slope hazard
                                                    4 -- Step  hazard
-1.0 .                                              5 -- Crosspath hazard
                                                    6 -- Bad data

-2.0 .
      --------------------------------> X
      0     1      2      3      4            Points off scale: 0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.29	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	1.36	1.31	-0.29	0.07	Step hazard
		1.34	1.31	-0.29	0.07	Slope hazard
13	-9.84	1.34	1.32	-0.23	0.09	Slope hazard
		1.37	1.35	-0.23	0.12	Slope hazard
		1.47	1.45	-0.25	0.22	Slope hazard
		1.63	1.60	-0.28	0.24	Slope hazard
		1.47	1.63	-0.29	0.29	Slope hazard
		1.72	1.70	-0.29	0.31	Slope hazard
14	-7.02	1.34	1.33	-0.16	0.09	Slope hazard
		1.37	1.36	-0.17	0.12	Slope hazard
		1.42	1.41	-0.17	0.13	Slope hazard
		1.47	1.46	-0.18	0.22	Slope hazard
		1.54	1.52	-0.19	0.23	Slope hazard
		1.47	1.66	-0.20	0.29	Slope hazard
		1.72	1.71	-0.21	0.31	Slope hazard
15	-4.22	1.34	1.34	-0.10	0.09	Slope hazard
		1.37	1.37	-0.10	0.12	Slope hazard
		1.47	1.47	-0.11	0.22	Slope hazard
		1.67	1.67	-0.12	0.29	Slope hazard
		1.72	1.72	-0.13	0.31	Slope hazard
16	-1.41	1.26	1.26	-0.03	0.02	Slope hazard
		1.34	1.34	-0.03	0.09	Slope hazard
		1.37	1.37	-0.03	0.12	Slope hazard
		1.42	1.42	-0.03	0.13	Slope hazard
		1.47	1.47	-0.04	0.22	Slope hazard
		1.54	1.53	-0.04	0.23	Slope hazard
		1.59	1.58	-0.04	0.28	Slope hazard
		1.67	1.67	-0.04	0.30	Slope hazard
17	1.40	1.26	1.26	0.03	0.02	Slope hazard
		1.34	1.34	0.03	0.09	Slope hazard
		1.37	1.37	0.03	0.12	Slope hazard
		1.42	1.42	0.03	0.13	Slope hazard
		1.47	1.47	0.04	0.22	Slope hazard
		1.53	1.53	0.04	0.26	Slope hazard
		1.59	1.58	0.04	0.29	Slope hazard
		1.63	1.63	0.04	0.34	Slope hazard
18	4.21	1.26	1.25	0.09	0.02	Slope hazard
		1.34	1.34	0.10	0.09	Slope hazard
		1.37	1.37	0.10	0.12	Slope hazard
		1.42	1.42	0.10	0.13	Slope hazard
		1.47	1.47	0.11	0.22	Slope hazard
		1.53	1.53	0.11	0.26	Slope hazard
		1.59	1.58	0.12	0.29	Slope hazard
		1.63	1.63	0.12	0.34	Slope hazard
19	7.02	1.26	1.25	0.15	0.02	Slope hazard
		1.34	1.33	0.16	0.09	Slope hazard
		1.37	1.36	0.17	0.12	Slope hazard
		1.42	1.41	0.17	0.13	Slope hazard
		1.47	1.46	0.18	0.22	Slope hazard
		1.54	1.52	0.19	0.22	Slope hazard
		1.59	1.57	0.19	0.28	Slope hazard
		1.63	1.62	0.20	0.34	Slope hazard
		1.72	1.71	0.21	0.32	Slope hazard
20	9.83	1.26	1.24	0.21	0.02	Slope hazard
		1.34	1.32	0.23	0.09	Slope hazard
		1.37	1.35	0.23	0.12	Slope hazard
		1.42	1.40	0.24	0.13	Slope hazard
		1.47	1.45	0.25	0.22	Slope hazard
		1.54	1.51	0.26	0.32	Slope hazard
		1.67	1.63	0.29	0.29	Slope hazard
		1.72	1.70	0.29	0.31	Slope hazard
21	12.64	1.47	1.44	0.32	0.22	Slope hazard
		1.54	1.50	0.34	0.23	Slope hazard
		1.63	1.59	0.36	0.33	Slope hazard
22	15.45	1.47	1.42	0.39	0.22	Slope hazard
		1.54	1.48	0.41	0.23	Slope hazard
		1.63	1.57	0.43	0.33	Slope hazard
23	18.26	1.37	1.31	0.43	0.11	Slope hazard
		1.47	1.40	0.46	0.22	Slope hazard
		1.54	1.46	0.48	0.33	Slope hazard
		1.60	1.51	0.50	0.23	Step hazard
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

7.2.3 Two Steps Test Results

Input file: MDL.TWO.14.00
File Creation Date : SAT. AUG 06 1983   System time   17:48:31

** MODEL1 PARAMETERS **

HEIGHT FILTER COEFFICIENT =	0.25
SLOPE FILTER COEFFICIENT =	0.90
LEVEL GROUND STEP THRESHOLD =	0.25 METERS
SLOPE THRESHOLD =	30.00 DEGREES

```
2.0 +                          . .
      I
      I                     . .          . .
      I                . .                    . .
1.0 +                   . .                 . .
      I                     . .          . .
      I                  . .                . .            X vs. Y for
      I                                                    hazards of
0.0 +             4 5 3 45                                   scan #  1
      I             4        4.
      I         44                  .                     Number key:
      I      . .  444       4    .                        1 -- Insufficient data
      I                        . .                        2 -- Furthest return .LT. 1.5m
-1.0 +               . .              .                   3 -- Slope hazard
      I                 . .         .                     4 -- Step  hazard
      I                   . .     . .                     5 -- Crosspath hazard
      I                     . .                           6 -- Bad data
      I                       . .
-2.0 +                     . .
      ---------------------------------------> X
      0       1       2       3       4            Points off scale:  0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	1.37	1.19	-0.67	-0.37	Step hazard
7	-26.69	1.33	1.18	-0.60	-0.37	Step hazard
		1.55	1.39	-0.70	-0.03	Step hazard
8	-23.88	1.33	1.21	-0.54	-0.38	Step hazard
		1.33	1.21	-0.54	-0.38	Step hazard
		1.33	1.21	-0.54	-0.38	Step hazard
		1.37	1.25	-0.55	-0.36	Step hazard
		1.41	1.29	-0.57	-0.34	Step hazard
9	-21.08	1.33	1.24	-0.48	-0.38	Step hazard
		1.33	1.24	-0.48	-0.38	Step hazard
		1.33	1.24	-0.48	-0.38	Step hazard
10	-18.26	1.33	1.26	-0.42	-0.38	Step hazard
		1.33	1.26	-0.42	-0.38	Step hazard
		1.33	1.26	-0.42	-0.38	Step hazard
		1.37	1.30	-0.43	-0.36	Step hazard
11	-15.45	1.29	1.24	-0.34	-0.37	Step hazard
		1.29	1.24	-0.34	-0.37	Step hazard
		1.29	1.24	-0.34	-0.37	Step hazard
		1.33	1.28	-0.35	-0.37	Step hazard
		1.96	1.89	-0.52	0.01	Step hazard
12	-12.64	1.29	1.26	-0.28	-0.37	Step hazard
		1.29	1.26	-0.28	-0.37	Step hazard
		1.29	1.26	-0.28	-0.37	Step hazard
		1.32	1.29	-0.29	-0.30	Step hazard
13	-9.84	1.32	1.30	-0.23	-0.30	Step hazard
		1.32	1.30	-0.23	-0.30	Step hazard
		1.37	1.35	-0.23	-0.08	Step hazard
14	-7.02	1.29	1.28	-0.16	-0.37	Step hazard
		1.29	1.28	-0.16	-0.37	Step hazard
		1.29	1.28	-0.16	-0.37	Step hazard
		1.32	1.31	-0.16	-0.30	Step hazard
		1.96	1.94	-0.24	0.00	Step hazard
15	-4.22	1.29	1.29	-0.09	-0.37	Step hazard
		1.29	1.29	-0.09	-0.37	Step hazard
		1.29	1.29	-0.09	-0.37	Step hazard
16	-1.41	1.29	1.29	-0.03	-0.37	Step hazard
		1.29	1.29	-0.03	-0.37	Step hazard
		1.29	1.29	-0.03	-0.37	Step hazard
		1.32	1.32	-0.03	-0.30	Step hazard
		1.50	1.50	-0.04	0.05	Crosspath hazard
		1.75	1.75	-0.04	0.01	Crosspath hazard
		1.88	1.88	-0.05	0.01	Step hazard
		2.00	2.00	-0.05	0.01	Crosspath hazard
17	1.40	N O	H A Z A R D S	C A T A L O G E D		
18	4.21	N O	H A Z A R D S	C A T A L O G E D		
19	7.02	N O	H A Z A R D S	C A T A L O G E D		
20	9.83	N O	H A Z A R D S	C A T A L O G E D		
21	12.64	N O	H A Z A R D S	C A T A L O G E D		
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.TWO.14.02
File Creation Date : SAT, AUG 06 1983   System time   17:54:08

== MODEL1 PARAMETERS ==

HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.90
LEVEL GROUND STEP THRESHOLD =   - 0.25 METERS
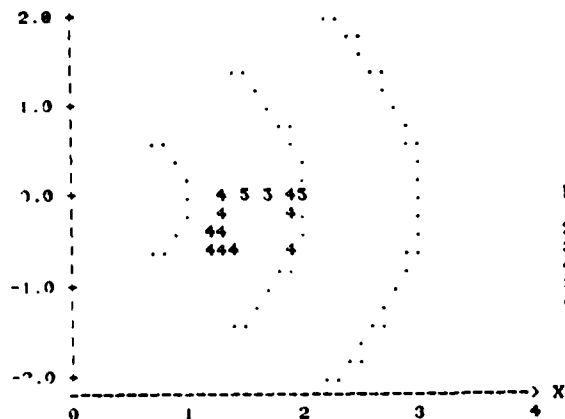SLOPE THRESHOLD =   30.00 DEGREES
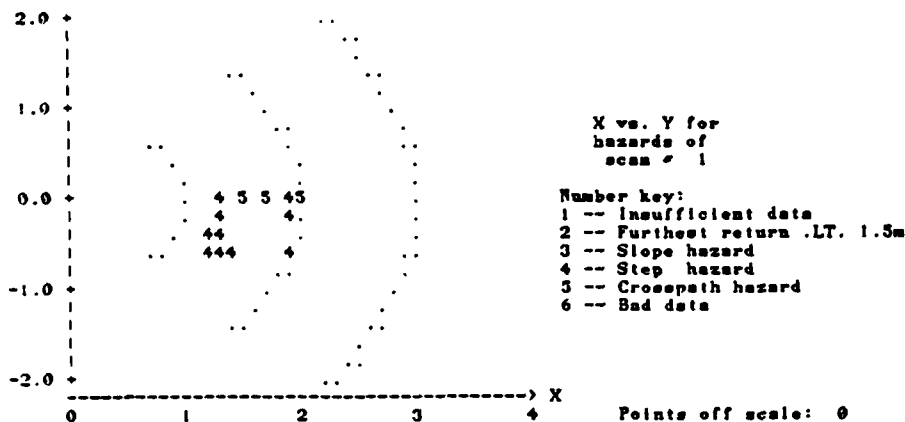
```
 2.0 +                    ..
     |
     |                ..        ..
     |
 1.0 +              .     .            X vs. Y for
     |                                 hazards of
     |          ..              ..     scan # 1
     |
 0.0 +       .   4 5 5 45       .      Number key:
     |        .  4        4.           1 -- Insufficient data
     |          44                     2 -- Furthest return .LT. 1.5m
     |          444      4             3 -- Slope hazard
     |       ..              .         4 -- Step  hazard
-1.0 +           .        .            5 -- Crosspath hazard
     |                                 6 -- Bad data
     |            ..
     |
-2.0 +          ..
     -------------------------------------> X
     0      1       2       3      4      Points off scale:  0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	1.37	1.19	-0.67	-0.37	Step hazard
7	-26.69	1.33	1.18	-0.60	-0.37	Step hazard
		1.55	1.39	-0.70	-0.03	Step hazard
8	-23.88	1.33	1.21	-0.54	-0.38	Step hazard
		1.33	1.21	-0.54	-0.38	Step hazard
		1.33	1.21	-0.54	-0.38	Step hazard
		1.37	1.25	-0.55	-0.36	Step hazard
		1.41	1.29	-0.57	-0.34	Step hazard
9	-21.08	1.33	1.24	-0.48	-0.38	Step hazard
		1.33	1.24	-0.48	-0.38	Step hazard
		1.33	1.24	-0.48	-0.38	Step hazard
10	-18.26	1.33	1.26	-0.42	-0.38	Step hazard
		1.33	1.26	-0.42	-0.38	Step hazard
		1.33	1.26	-0.42	-0.38	Step hazard
		1.37	1.30	-0.43	-0.36	Step hazard
11	-15.45	1.29	1.24	-0.34	-0.37	Step hazard
		1.29	1.24	-0.34	-0.37	Step hazard
		1.29	1.24	-0.34	-0.37	Step hazard
		1.33	1.28	-0.35	-0.37	Step hazard
		1.96	1.89	-0.52	0.01	Step hazard
12	-12.64	1.29	1.26	-0.28	-0.37	Step hazard
		1.29	1.26	-0.28	-0.37	Step hazard
		1.29	1.26	-0.28	-0.37	Step hazard
		1.32	1.29	-0.29	-0.30	Step hazard
13	-9.84	1.32	1.30	-0.23	-0.30	Step hazard
		1.32	1.30	-0.23	-0.30	Step hazard
		1.37	1.35	-0.23	-0.08	Step hazard
14	-7.02	1.29	1.28	-0.16	-0.37	Step hazard
		1.29	1.28	-0.16	-0.37	Step hazard
		1.29	1.28	-0.16	-0.37	Step hazard
		1.32	1.31	-0.16	-0.30	Step hazard
		1.96	1.94	-0.24	0.00	Step hazard
15	-4.22	1.29	1.29	-0.09	-0.37	Step hazard
		1.29	1.29	-0.09	-0.37	Step hazard
		1.29	1.29	-0.09	-0.37	Step hazard
16	-1.41	1.29	1.29	-0.03	-0.37	Step hazard
		1.29	1.29	-0.03	-0.37	Step hazard
		1.29	1.29	-0.03	-0.37	Step hazard
		1.32	1.32	-0.03	-0.30	Step hazard
		1.50	1.50	-0.04	0.05	Crosspath hazard
		1.75	1.75	-0.04	0.01	Crosspath hazard
		1.88	1.88	-0.05	0.01	Step hazard
		2.00	2.00	-0.05	0.01	Crosspath hazard
17	1.40	N O	H A Z A R D S	C A T A L O G E D		
18	4.21	N O	H A Z A R D S	C A T A L O G E D		
19	7.02	N O	H A Z A R D S	C A T A L O G E D		
20	9.83	N O	H A Z A R D S	C A T A L O G E D		
21	12.64	N O	H A Z A R D S	C A T A L O G E D		
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.TWO.14.04
File Creation Date : SAT. AUG 06 1983   System time   17:58:10

```
                    **  MODEL1 PARAMETERS  **
            HEIGHT FILTER COEFFICIENT  =          0.25
            SLOPE FILTER COEFFICIENT   =          0.90
            LEVEL GROUND STEP THRESHOLD =         0.25 METERS
            SLOPE THRESHOLD =                    30.00 DEGREES
```
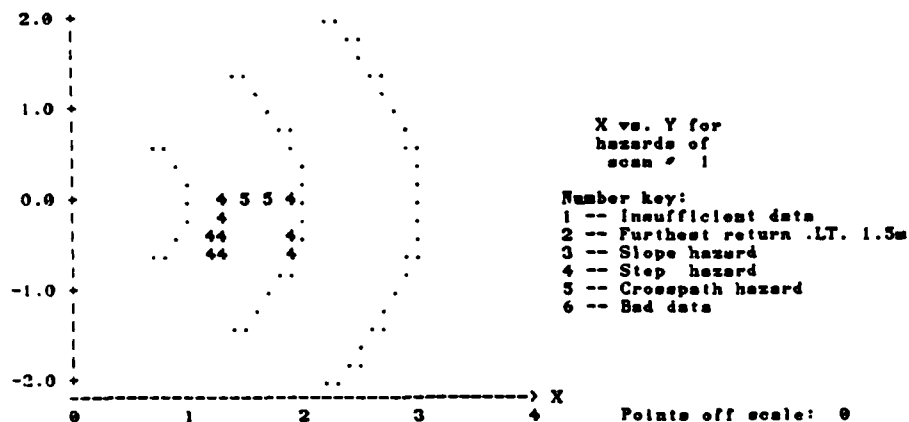


```
X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step  hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale:  0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	1.37	1.19	-0.67	-0.37	Step hazard
7	-26.69	1.33	1.18	-0.60	-0.37	Step hazard
		1.37	1.22	-0.61	-0.36	Step hazard
8	-23.88	1.33	1.21	-0.54	-0.38	Step hazard
		1.41	1.29	-0.57	-0.34	Step hazard
		1.41	1.29	-0.57	-0.34	Step hazard
9	-21.08	1.33	1.24	-0.48	-0.38	Step hazard
		1.33	1.24	-0.48	-0.38	Step hazard
		1.33	1.24	-0.48	-0.38	Step hazard
		1.33	1.24	-0.48	-0.38	Step hazard
10	-18.26	1.29	1.22	-0.40	-0.37	Step hazard
		1.29	1.22	-0.40	-0.37	Step hazard
		1.33	1.26	-0.42	-0.37	Step hazard
		1.37	1.30	-0.43	-0.29	Step hazard
		1.29	1.24	-0.34	-0.37	Step hazard
		1.29	1.24	-0.34	-0.37	Step hazard
		1.33	1.28	-0.35	-0.37	Step hazard
		1.96	1.89	-0.52	0.01	Step hazard
12	-12.64	1.29	1.26	-0.28	-0.37	Step hazard
		1.29	1.26	-0.28	-0.37	Step hazard
		1.29	1.26	-0.28	-0.37	Step hazard
		1.33	1.29	-0.29	-0.37	Step hazard
13	-9.84	1.32	1.30	-0.23	-0.30	Step hazard
		1.32	1.30	-0.23	-0.30	Step hazard
		1.37	1.35	-0.23	-0.08	Step hazard
		1.96	1.93	-0.33	0.00	Step hazard
14	-7.02	1.29	1.28	-0.16	-0.37	Step hazard
		1.29	1.28	-0.16	-0.37	Step hazard
		1.29	1.28	-0.16	-0.37	Step hazard
		1.32	1.31	-0.16	-0.30	Step hazard
15	-4.22	1.29	1.29	-0.09	-0.37	Step hazard
		1.29	1.29	-0.09	-0.37	Step hazard
		1.29	1.29	-0.09	-0.37	Step hazard
16	-1.41	1.29	1.29	-0.03	-0.37	Step hazard
		1.29	1.29	-0.03	-0.37	Step hazard
		1.29	1.29	-0.03	-0.37	Step hazard
		1.33	1.32	-0.03	-0.37	Step hazard
		1.50	1.50	-0.04	0.05	Crosspath hazard
		1.73	1.75	-0.04	0.01	Crosspath hazard
		1.88	1.88	-0.05	0.02	Step hazard
17	1.40	N O	H A Z A R D S	C A T A L O G E D		
18	4.21	N O	H A Z A R D S	C A T A L O G E D		
19	7.02	N O	H A Z A R D S	C A T A L O G E D		
20	9.83	N O	H A Z A R D S	C A T A L O G E D		
21	12.64	N O	H A Z A R D S	C A T A L O G E D		
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.TWO.14.06
File Creation Date : SAT, AUG 06 1983   System time   18:06:45
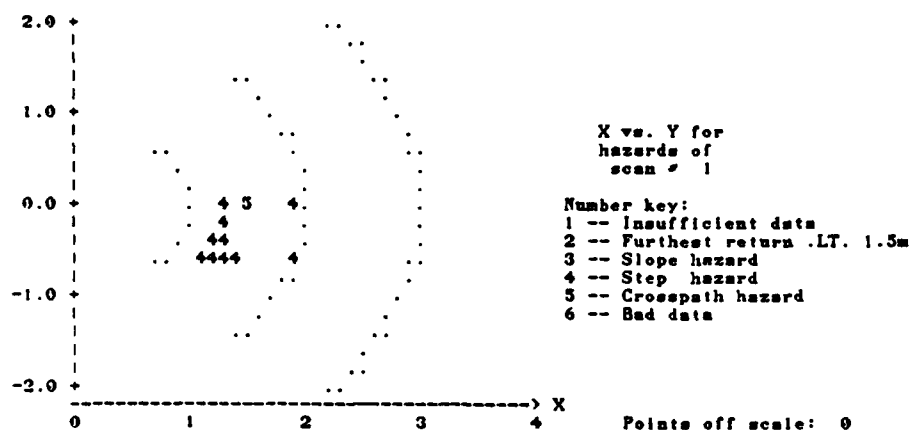
```
        **   MODEL1 PARAMETERS   **
      HEIGHT FILTER COEFFICIENT  =        0.25
      SLOPE FILTER COEFFICIENT   =        0.90
      LEVEL GROUND STEP THRESHOLD =       0.25 METERS
      SLOPE THRESHOLD  =                 30.00 DEGREES
```


X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A	L O G E D	
2	-40.74	N O	H A Z A R D S	C A T A	L O G E D	
3	-37.93	N O	H A Z A R D S	C A T A	L O G E D	
4	-35.13	N O	H A Z A R D S	C A T A	L O G E D	
5	-32.31	N O	H A Z A R D S	C A T A	L O G E D	
6	-29.50	1.29	1.12	-0.63	-0.37	Step hazard
7	-26.69	1.33	1.18	-0.60	-0.37	Step hazard
		1.55	1.39	-0.70	-0.03	Step hazard
8	-23.88	1.33	1.21	-0.54	-0.38	Step hazard
		1.41	1.29	-0.57	-0.34	Step hazard
		1.41	1.29	-0.57	-0.34	Step hazard
9	-21.08	1.33	1.24	-0.48	-0.38	Step hazard
		1.33	1.24	-0.48	-0.38	Step hazard
		1.33	1.24	-0.48	-0.38	Step hazard
		1.41	1.31	-0.51	-0.28	Step hazard
10	-18.26	1.29	1.22	-0.40	-0.37	Step hazard
		1.29	1.22	-0.40	-0.37	Step hazard
		1.33	1.26	-0.42	-0.37	Step hazard
		1.37	1.30	-0.43	-0.36	Step hazard
		2.04	1.93	-0.64	-0.01	Step hazard
11	-15.45	1.29	1.24	-0.34	-0.37	Step hazard
		1.29	1.24	-0.34	-0.37	Step hazard
		1.29	1.24	-0.34	-0.37	Step hazard
		1.33	1.28	-0.35	-0.37	Step hazard
		1.96	1.89	-0.52	0.01	Step hazard
12	-12.64	1.33	1.29	-0.29	-0.38	Step hazard
		1.33	1.29	-0.29	-0.38	Step hazard
		1.33	1.29	-0.29	-0.38	Step hazard
		1.33	1.29	-0.29	-0.38	Step hazard
13	-9.84	1.33	1.31	-0.23	-0.38	Step hazard
		1.33	1.31	-0.23	-0.38	Step hazard
		1.33	1.31	-0.23	-0.38	Step hazard
		1.33	1.31	-0.23	-0.38	Step hazard
14	-7.02	1.29	1.28	-0.16	-0.37	Step hazard
		1.29	1.28	-0.16	-0.37	Step hazard
		1.29	1.28	-0.16	-0.37	Step hazard
		1.32	1.31	-0.16	-0.30	Step hazard
15	-4.22	1.29	1.29	-0.09	-0.37	Step hazard
		1.29	1.29	-0.09	-0.37	Step hazard
		1.29	1.29	-0.09	-0.37	Step hazard
16	-1.41	1.33	1.32	-0.03	-0.38	Step hazard
		1.33	1.32	-0.03	-0.38	Step hazard
		1.33	1.32	-0.03	-0.38	Step hazard
		1.33	1.32	-0.03	-0.38	Step hazard
		1.50	1.50	-0.04	0.05	Crosspath hazard
		1.88	1.88	-0.05	0.00	Step hazard
17	1.40	N O	H A Z A R D S	C A T A	L O G E D	
18	4.21	N O	H A Z A R D S	C A T A	L O G E D	
19	7.02	N O	H A Z A R D S	C A T A	L O G E D	
20	9.83	N O	H A Z A R D S	C A T A	L O G E D	
21	12.64	N O	H A Z A R D S	C A T A	L O G E D	
22	15.45	N O	H A Z A R D S	C A T A	L O G E D	
23	18.26	N O	H A Z A R D S	C A T A	L O G E D	
24	21.07	N O	H A Z A R D S	C A T A	L O G E D	
25	23.88	N O	H A Z A R D S	C A T A	L O G E D	
26	26.69	N O	H A Z A R D S	C A T A	L O G E D	
27	29.50	N O	H A Z A R D S	C A T A	L O G E D	
28	32.31	N O	H A Z A R D S	C A T A	L O G E D	
29	35.12	N O	H A Z A R D S	C A T A	L O G E D	
30	37.93	N O	H A Z A R D S	C A T A	L O G E D	
31	40.74	N O	H A Z A R D S	C A T A	L O G E D	
32	43.55	N O	H A Z A R D S	C A T A	L O G E D	

Input file: MDL.TWO.14.08
File Creation Date : SAT. AUG 06 1983   System time   23:57:20

```
            **  MODEL1 PARAMETERS  **
      HEIGHT FILTER COEFFICIENT =          0.25
      SLOPE FILTER COEFFICIENT  =          0.90
      LEVEL GROUND STEP THRESHOLD =        0.25 METERS
      SLOPE THRESHOLD =                   30.00 DEGREES
```


X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S		C A T A L O G E D	
2	-40.74	N O	H A Z A R D S		C A T A L O G E D	
3	-37.93	N O	H A Z A R D S		C A T A L O G E D	
4	-35.13	N O	H A Z A R D S		C A T A L O G E D	
5	-32.31	N O	H A Z A R D S		C A T A L O G E D	
6	-29.50s	1.33	1.15	-0.63	-0.37	Step hazard
7	-26.69	1.33	1.18	-0.60	-0.38	Step hazard
		1.33	1.18	-0.60	-0.38	Step hazard
		1.33	1.18	-0.60	-0.38	Step hazard
		1.41	1.26	-0.63	-0.34	Step hazard
		1.41	1.26	-0.63	-0.34	Step hazard
		1.72	1.53	-0.77	0.01	Step hazard
8	-23.88	1.33	1.21	-0.54	-0.38	Step hazard
		1.33	1.21	-0.54	-0.38	Step hazard
		1.33	1.21	-0.54	-0.38	Step hazard
		1.41	1.29	-0.57	-0.34	Step hazard
		1.41	1.29	-0.57	-0.34	Step hazard
9	-21.08	1.29	1.20	-0.46	-0.37	Step hazard
		1.29	1.20	-0.46	-0.37	Step hazard
		1.33	1.24	-0.48	-0.37	Step hazard
		1.37	1.27	-0.49	-0.29	Step hazard
10	-18.26	1.29	1.22	-0.40	-0.37	Step hazard
		1.29	1.22	-0.40	-0.37	Step hazard
		1.33	1.26	-0.42	-0.37	Step hazard
11	-15.45	1.33	1.28	-0.35	-0.38	Step hazard
		1.33	1.28	-0.35	-0.38	Step hazard
		1.33	1.28	-0.35	-0.38	Step hazard
12	-12.64	1.33	1.29	-0.29	-0.38	Step hazard
		1.33	1.29	-0.29	-0.38	Step hazard
		1.33	1.29	-0.29	-0.38	Step hazard
		1.33	1.29	-0.29	-0.38	Step hazard
13	-9.84	1.29	1.27	-0.22	-0.37	Step hazard
		1.29	1.27	-0.22	-0.37	Step hazard
		1.29	1.27	-0.22	-0.37	Step hazard
		1.32	1.30	-0.23	-0.30	Step hazard
		1.88	1.85	-0.32	0.03	Step hazard
14	-7.02	1.29	1.28	-0.16	-0.37	Step hazard
		1.29	1.28	-0.16	-0.37	Step hazard
		1.29	1.28	-0.16	-0.37	Step hazard
15	-4.22	1.33	1.32	-0.10	-0.38	Step hazard
		1.33	1.32	-0.10	-0.38	Step hazard
		1.33	1.32	-0.10	-0.38	Step hazard
		1.88	1.87	-0.14	0.00	Step hazard
16	-1.41	N O	H A Z A R D S		C A T A L O G E D	
17	1.40	N O	H A Z A R D S		C A T A L O G E D	
18	4.21	N O	H A Z A R D S		C A T A L O G E D	
19	7.02	N O	H A Z A R D S		C A T A L O G E D	
20	9.83	N O	H A Z A R D S		C A T A L O G E D	
21	12.64	N O	H A Z A R D S		C A T A L O G E D	
22	15.45	N O	H A Z A R D S		C A T A L O G E D	
23	18.26	N O	H A Z A R D S		C A T A L O G E D	
24	21.07	N O	H A Z A R D S		C A T A L O G E D	
25	23.88	N O	H A Z A R D S		C A T A L O G E D	
26	26.69	N O	H A Z A R D S		C A T A L O G E D	
27	29.50	N O	H A Z A R D S		C A T A L O G E D	
28	32.31	N O	H A Z A R D S		C A T A L O G E D	
29	35.12	N O	H A Z A R D S		C A T A L O G E D	
30	37.93	N O	H A Z A R D S		C A T A L O G E D	
31	40.74	N O	H A Z A R D S		C A T A L O G E D	
32	43.55	N O	H A Z A R D S		C A T A L O G E D	

Input file: MDL.TWO.14.10
File Creation Date : SUN, AUG 07 1983   System time   00:06:11

```
            **  MODEL1 PARAMETERS  **
      HEIGHT FILTER COEFFICIENT  =        0.25
      SLOPE FILTER COEFFICIENT   =        0.90
      LEVEL GROUND STEP THRESHOLD =       0.25 METERS
      SLOPE THRESHOLD =                  30.00 DEGREES
```
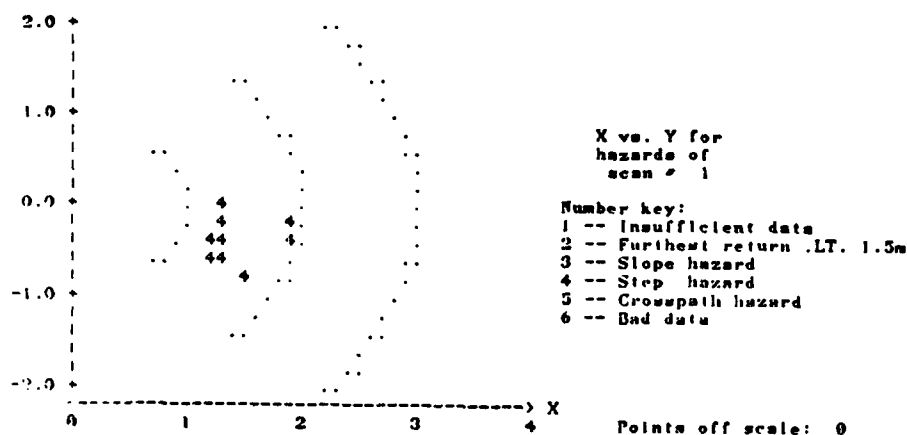

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13,	N O	H A Z A R D S	C A T A L O G E D		
5	-32.3	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	1.33	1.15	-0.65	-0.38	Step hazard
7	-26.69	1.45	1.29	-0.65	-0.32	Step hazard
		1.72	1.55	-0.77	0.01	Step hazard
8	-23.88	1.33	1.21	-0.54	-0.38	Step hazard
		1.33	1.21	-0.54	-0.38	Step hazard
		1.41	1.29	-0.57	-0.35	Step hazard
		1.41	1.29	-0.57	-0.35	Step hazard
		1.96	1.79	-0.79	0.01	Step hazard
9	-21.08	1.29	1.20	-0.46	-0.37	Step hazard
		1.29	1.20	-0.46	-0.37	Step hazard
		1.33	1.24	-0.48	-0.37	Step hazard
		1.37	1.27	-0.49	-0.29	Step hazard
10	-18.26	1.33	1.26	-0.42	-0.38	Step hazard
		1.33	1.26	-0.42	-0.38	Step hazard
		1.33	1.26	-0.42	-0.38	Step hazard
		1.37	1.30	-0.43	-0.36	Step hazard
11	-15.45	1.33	1.28	-0.35	-0.38	Step hazard
		1.33	1.28	-0.35	-0.38	Step hazard
		1.36	1.31	-0.36	-0.22	Step hazard
12	-12.64	1.29	1.26	-0.28	-0.37	Step hazard
		1.29	1.26	-0.28	-0.37	Step hazard
		1.29	1.26	-0.28	-0.37	Step hazard
		1.32	1.29	-0.29	-0.30	Step hazard
		1.96	1.91	-0.43	0.00	Step hazard
13	-9.84	1.29	1.27	-0.22	-0.37	Step hazard
		1.29	1.27	-0.22	-0.37	Step hazard
		1.29	1.27	-0.22	-0.37	Step hazard
14	-7.02	1.29	1.28	-0.16	-0.37	Step hazard
		1.29	1.28	-0.16	-0.37	Step hazard
		1.29	1.28	-0.16	-0.37	Step hazard
		1.33	1.32	-0.16	-0.37	Step hazard
15	-4.22	1.33	1.32	-0.10	-0.38	Step hazard
		1.33	1.32	-0.10	-0.38	Step hazard
		1.33	1.32	-0.10	-0.38	Step hazard
		1.33	1.32	-0.10	-0.38	Step hazard
		1.80	1.87	-0.14	0.01	Step hazard
16	-1.41	1.33	1.32	-0.03	-0.38	Step hazard
17	1.40	1.29	1.29	0.03	-0.37	Step hazard
18	4.21	1.33	1.32	0.10	-0.38	Step hazard
19	7.02	1.33	1.32	0.16	-0.38	Step hazard
20	9.83	1.33	1.31	0.23	-0.38	Step hazard
21	12.64	1.33	1.29	0.29	-0.38	Step hazard
22	15.45	1.37	1.32	0.36	-0.37	Step hazard
23	18.26	1.37	1.30	0.43	-0.37	Step hazard
24	21.07	1.33	1.24	0.48	-0.38	Step hazard
25	23.88	1.29	1.18	0.52	-0.37	Step hazard
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.TWO.14.12
File Creation Date : SUN, AUG 07 1983   System time   00:16:34

```
                   ==  MODEL1 PARAMETERS  ==
            REIGHT FILTER COEFFICIENT =        0.25
            SLOPE FILTER COEFFICIENT  =        0.90
            LEVEL GROUND STEP THRESHOLD =      0.25 METERS
            SLOPE THRESHOLD  =                30.00 DEGREES
```



```
2.0 +                        ..
    |                         ..
    |                     ..       ..
    |                 ..               ..
1.0 +                                               X vs. Y for
    |          ..        .                .         hazards of
    |       ..    44    4.                  .       area / 1
    |      .     444  4                       .
    |            44                                 Number key:
0.0 +            44                                 1 -- Insufficient data
    |         .  4                .                 2 -- Furthest return .LT. 1.5m
    |            4   4.                             3 -- Slope hazard
    |       ..   44                                 4 -- Step  hazard
    |            4.                          .      5 -- Crosspath hazard
-1.0 +            4  .                       .      6 -- Bad data
    |        ..             .
    |                      ..
    |                     ..
-2.0 +                   ..
    --------------------------------------------> X
    0       1       2       3       4             Points off scale:  0
```

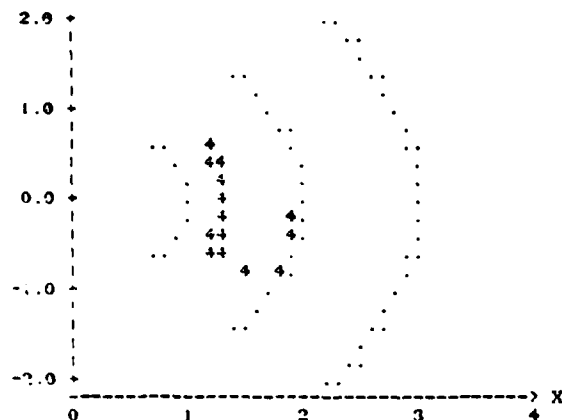| AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	1.37	1.19	-0.67	-0.37	Step hazard
7	-26.69	1.45	1.29	-0.65	-0.32	Step hazard
8	-23.88	1.29	1.18	-0.52	-0.37	Step hazard
		1.33	1.21	-0.54	-0.37	Step hazard
		1.37	1.25	-0.55	-0.36	Step hazard
		1.41	1.29	-0.57	-0.34	Step hazard
		1.76	1.61	-0.71	0.07	Step hazard
9	-21.08	1.29	1.20	-0.46	-0.37	Step hazard
		1.29	1.20	-0.46	-0.37	Step hazard
		1.33	1.24	-0.48	-0.37	Step hazard
		1.37	1.27	-0.49	-0.29	Step hazard
10	-18.26	1.33	1.26	-0.42	-0.38	Step hazard
		1.33	1.26	-0.42	-0.38	Step hazard
		1.33	1.26	-0.42	-0.38	Step hazard
11	-15.45	1.33	1.28	-0.35	-0.38	Step hazard
		1.33	1.28	-0.35	-0.38	Step hazard
		1.33	1.28	-0.35	-0.38	Step hazard
12	-12.64	1.29	1.26	-0.28	-0.37	Step hazard
		1.29	1.26	-0.28	-0.37	Step hazard
		1.29	1.26	-0.28	-0.37	Step hazard
		1.32	1.29	-0.29	-0.30	Step hazard
13	-9.84	1.29	1.27	-0.22	-0.37	Step hazard
		1.29	1.27	-0.22	-0.37	Step hazard
		1.29	1.27	-0.22	-0.37	Step hazard
		1.32	1.30	-0.23	-0.30	Step hazard
14	-7.02	1.33	1.32	-0.16	-0.38	Step hazard
		1.33	1.32	-0.16	-0.38	Step hazard
		1.33	1.32	-0.16	-0.38	Step hazard
		1.96	1.94	-0.24	0.00	Step hazard
15	-4.22	1.33	1.32	-0.10	-0.38	Step hazard
		1.33	1.32	-0.10	-0.38	Step hazard
		1.33	1.32	-0.10	-0.38	Step hazard
		1.33	1.32	-0.10	-0.38	Step hazard
16	-1.41	1.29	1.29	-0.03	-0.37	Step hazard
		1.29	1.29	-0.03	-0.37	Step hazard
		1.29	1.29	-0.03	-0.37	Step hazard
17	1.40	1.29	1.29	0.03	-0.37	Step hazard
		1.37	1.37	0.03	-0.36	Step hazard
18	4.21	1.33	1.32	0.10	-0.38	Step hazard
		1.37	1.36	0.10	-0.36	Step hazard
19	7.02	1.33	1.32	0.16	-0.38	Step hazard
		1.37	1.36	0.17	-0.36	Step hazard
20	9.83	1.29	1.27	0.22	-0.37	Step hazard
		1.37	1.35	0.23	-0.36	Step hazard
21	12.64	1.29	1.26	0.28	-0.37	Step hazard
		1.37	1.33	0.30	-0.36	Step hazard
		1.88	1.83	0.41	-0.00	Step hazard
22	15.45	1.33	1.28	0.35	-0.38	Step hazard
		1.37	1.32	0.36	-0.36	Step hazard
		1.45	1.39	0.39	-0.32	Step hazard
23	18.26	1.33	1.26	0.42	-0.38	Step hazard
		1.37	1.30	0.43	-0.36	Step hazard
		1.45	1.37	0.45	-0.32	Step hazard
24	21.07	1.29	1.20	0.46	-0.37	Step hazard
		1.37	1.27	0.49	-0.36	Step hazard
		1.45	1.35	0.52	-0.32	Step hazard
		1.88	1.75	0.68	-0.00	Step hazard
25	23.88	1.29	1.18	0.52	-0.37	Step hazard
		1.37	1.25	0.55	-0.36	Step hazard
		1.45	1.32	0.59	-0.32	Step hazard
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	1.37	1.19	0.67	-0.37	Step hazard
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.TWO.14.14
File Creation Date : SUN, AUG 07 1983   System time   00:21:28

== MODEL1 PARAMETERS ==
HEIGHT FILTER COEFFICIENT •   0.25
SLOPE FILTER COEFFICIENT •   0.90
LEVEL GROUND STEP THRESHOLD •   0.25 METERS
SLOPE THRESHOLD •   -   30.00 DEGREES
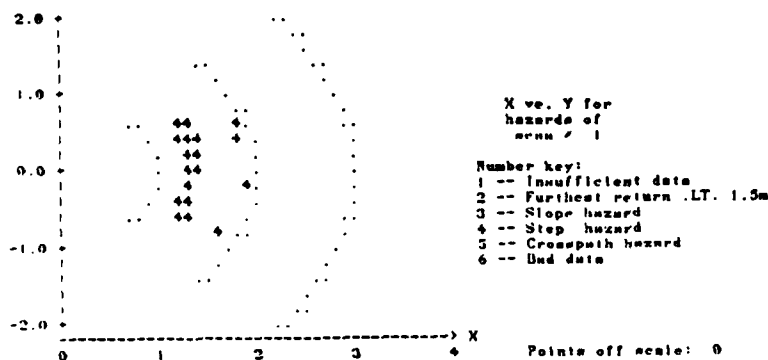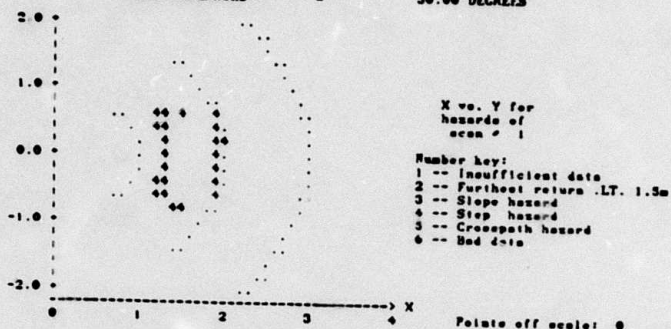

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH (deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.36	NO	HAZARDS	CATALOGED	
2	-40.74	NO	HAZARDS	CATALOGED	
3	-37.93	NO	HAZARDS	CATALOGED	
4	-35.13	NO	HAZARDS	CATALOGED	
5	-32.31	NO	HAZARDS	CATALOGED	
6	-29.50	1.33	1.15	-0.63	-0.38	Step hazard
		1.33	1.15	-0.65	-0.38	Step hazard
		1.37	1.19	-0.67	-0.36	Step hazard
		1.60	1.39	-0.79	0.02	Step hazard
7	-26.69	1.33	1.15	-0.58	-0.37	Step hazard
		1.33	1.18	-0.60	-0.37	Step hazard
		1.37	1.22	-0.61	-0.36	Step hazard
		1.41	1.26	-0.63	-0.34	Step hazard
		1.72	1.53	-0.77	0.01	Step hazard
8	-23.88	1.29	1.18	-0.52	-0.37	Step hazard
		1.29	1.18	-0.52	-0.37	Step hazard
		1.33	1.21	-0.54	-0.37	Step hazard
		1.37	1.25	-0.55	-0.29	Step hazard
9	-21.08	1.33	1.24	-0.48	-0.38	Step hazard
		1.33	1.24	-0.48	-0.38	Step hazard
		1.33	1.26	-0.42	-0.38	Step hazard
10	-18.26	1.33	1.26	-0.42	-0.38	Step hazard
		1.33	1.26	-0.42	-0.38	Step hazard
		1.33	1.26	-0.42	-0.38	Step hazard
11	-15.45	1.29	1.24	-0.34	-0.37	Step hazard
		1.29	1.24	-0.34	-0.37	Step hazard
		1.29	1.24	-0.34	-0.37	Step hazard
		1.32	1.28	-0.35	-0.30	Step hazard
12	-12.64	1.96	1.89	-0.52	-0.01	Step hazard
		1.29	1.26	-0.28	-0.37	Step hazard
		1.29	1.26	-0.28	-0.37	Step hazard
13	-9.84	1.33	1.31	-0.23	-0.38	Step hazard
		1.33	1.31	-0.23	-0.38	Step hazard
		1.33	1.31	-0.23	-0.38	Step hazard
		1.33	1.31	-0.23	-0.38	Step hazard
14	-7.02	1.96	1.93	-0.33	0.00	Step hazard
		1.33	1.32	-0.16	-0.38	Step hazard
		1.33	1.32	-0.16	-0.38	Step hazard
		1.33	1.32	-0.16	-0.38	Step hazard
15	-4.22	1.88	1.87	-0.23	0.01	Step hazard
		1.29	1.29	-0.09	-0.37	Step hazard
		1.29	1.29	-0.09	-0.37	Step hazard
16	-1.41	1.29	1.29	-0.03	-0.37	Step hazard
		1.29	1.29	-0.03	-0.37	Step hazard
		1.29	1.29	-0.03	-0.37	Step hazard
17	1.40	1.33	1.32	0.03	-0.38	Step hazard
		1.33	1.32	0.03	-0.38	Step hazard
		1.33	1.32	0.03	-0.38	Step hazard
		1.88	1.88	0.05	0.00	Step hazard
18	4.21	1.33	1.32	0.10	-0.38	Step hazard
		1.33	1.32	0.10	-0.38	Step hazard
		1.33	1.32	0.10	-0.38	Step hazard
19	7.02	1.29	1.28	0.16	-0.37	Step hazard
		1.29	1.28	0.16	-0.37	Step hazard
		1.29	1.28	0.16	-0.37	Step hazard
		1.32	1.31	0.16	-0.30	Step hazard
20	9.83	1.96	1.94	0.24	0.00	Step hazard
		1.29	1.27	0.22	-0.37	Step hazard
		1.29	1.27	0.22	-0.37	Step hazard
		1.29	1.27	0.22	-0.37	Step hazard
21	12.64	1.32	1.30	0.33	-0.30	Step hazard
		1.33	1.29	0.29	-0.38	Step hazard
		1.33	1.29	0.29	-0.38	Step hazard
		1.33	1.29	0.29	-0.38	Step hazard
22	15.45	1.96	1.91	0.43	0.00	Step hazard
		1.33	1.28	0.35	-0.38	Step hazard
		1.33	1.28	0.35	-0.38	Step hazard
23	18.26	1.33	1.28	0.35	-0.38	Step hazard
		1.33	1.26	0.42	-0.38	Step hazard
		1.33	1.26	0.42	-0.38	Step hazard
		1.33	1.26	0.42	-0.38	Step hazard
		1.37	1.30	0.43	-0.36	Step hazard
		2.04	1.93	0.64	-0.01	Step hazard
24	21.07	1.29	1.20	0.46	-0.38	Step hazard
		1.33	1.24	0.46	-0.37	Step hazard
		1.37	1.27	0.48	-0.36	Step hazard
25	23.88	1.33	1.21	0.49	-0.38	Step hazard
		1.41	1.28	0.54	-0.34	Step hazard
		1.63	1.51	0.57	-0.02	Step hazard
26	26.69	1.33	1.18	0.67	-0.38	Step hazard
27	29.50	NO	HAZARDS	CATALOGED	
28	32.31	NO	HAZARDS	CATALOGED	
29	35.12	NO	HAZARDS	CATALOGED	
30	37.93	NO	HAZARDS	CATALOGED	
31	40.74	NO	HAZARDS	CATALOGED	
32	43.55	NO	HAZARDS	CATALOGED	

7.2.4 Parallel Obstacles Test Results

Input file: MDL.PATH.10
File Creation Date : WED, AUG 10 1983   System time   19:27:37

```
              ** MODEL1 PARAMETERS  **
      HEIGHT FILTER COEFFICIENT =   ~      0.25
      SLOPE FILTER COEFFICIENT  =          0.90
      LEVEL GROUND STEP THRESHOLD =        0.25 METERS
      SLOPE THRESHOLD =                   30.00 DEGREES
```
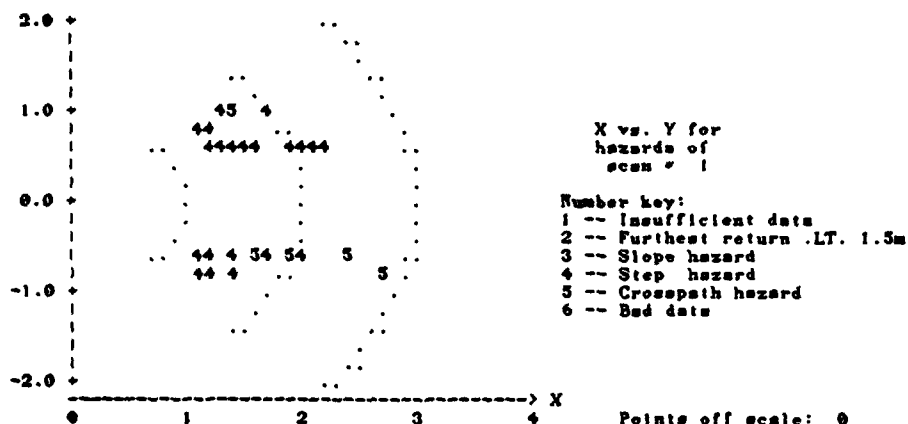
```
2.0 +                 ..
    |                ..          .
    |              ..               .
    |                                .
1.0 +         45  4                   .
    |    44                            .
    |  .. 44444  4444                  ..
    |                                   .
0.0 +                                    .
    |  ..        :                      ..
    |                                   .
    |  ..  44 4 34 54   5            ..
    |      44 4     ..        5  .
-1.0 +                               .
    |                              .
    |           ..                .
    |                           ..
-2.0 +              ..
    +------------------------------------> X
    0       1       2       3       4
```

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O H A Z A R D S C A T A L O G E D				
2	-40.74	N O H A Z A R D S C A T A L O G E D				
3	-37.93	N O H A Z A R D S C A T A L O G E D				
4	-35.13	1.37	1.12	-0.79	-0.36	Step hazard
5	-32.31	1.29	1.09	-0.69	-0.37	Step hazard
		1.41	1.19	-0.75	-0.34	Step hazard
		1.41	1.19	-0.75	-0.34	Step hazard
		1.65	1.40	-0.88	0.01	Step hazard
6	-29.50	1.33	1.15	-0.65	-0.38	Step hazard
		1.33	1.15	-0.65	-0.38	Step hazard
		1.33	1.15	-0.65	-0.38	Step hazard
		1.33	1.15	-0.65	-0.38	Step hazard
7	-26.69	1.33	1.18	-0.60	-0.38	Step hazard
		1.33	1.18	-0.60	-0.38	Step hazard
		1.33	1.18	-0.60	-0.38	Step hazard
8	-23.88	1.29	1.18	-0.52	-0.37	Step hazard
		1.29	1.18	-0.52	-0.37	Step hazard
		1.33	1.21	-0.54	-0.37	Step hazard
		1.37	1.25	-0.55	-0.36	Step hazard
		1.50	1.37	-0.61	0.04	Crosspath hazard
9	-21.08	1.55	1.44	-0.56	-0.23	Step hazard
		1.72	1.60	-0.62	-0.00	Step hazard
		1.75	1.63	-0.63	-0.00	Crosspath hazard
10	-18.26	1.84	1.74	-0.58	-0.11	Step hazard
		2.00	1.90	-0.63	-0.00	Crosspath hazard
11	-15.45	2.09	2.01	-0.56	-0.37	Step hazard
		2.50	2.41	-0.67	-0.07	Crosspath hazard
		2.75	2.65	-0.73	-0.05	Crosspath hazard
12	-12.64	N O H A Z A R D S C A T A L O G E D				
13	-9.84	N O H A Z A R D S C A T A L O G E D				
14	-7.02	N O H A Z A R D S C A T A L O G E D				
15	-4.22	N O H A Z A R D S C A T A L O G E D				
16	-1.41	N O H A Z A R D S C A T A L O G E D				
17	1.40	N O H A Z A R D S C A T A L O G E D				
18	4.21	N O H A Z A R D S C A T A L O G E D				
19	7.02	N O H A Z A R D S C A T A L O G E D				
20	9.83	N O H A Z A R D S C A T A L O G E D				
21	12.64	N O H A Z A R D S C A T A L O G E D				
22	15.45	2.09	2.01	0.56	-0.37	Step hazard
		2.16	2.08	0.57	-0.18	Step hazard
		2.29	2.21	0.61	-0.29	Step hazard
23	18.26	1.97	1.87	0.62	-0.20	Step hazard
		2.04	1.93	0.64	-0.06	Step hazard
24	21.07	1.61	1.51	0.58	-0.38	Step hazard
		1.71	1.60	0.61	-0.31	Step hazard
25	23.88	1.51	1.38	0.61	-0.25	Step hazard
26	26.69	1.33	1.18	0.60	-0.37	Step hazard
		1.41	1.26	0.63	-0.34	Step hazard
		1.41	1.26	0.63	-0.34	Step hazard
27	29.50	1.33	1.15	0.65	-0.38	Step hazard
		1.41	1.22	0.69	-0.34	Step hazard
		1.41	1.22	0.69	-0.34	Step hazard
		1.96	1.70	0.96	0.00	Step hazard
28	32.31	1.33	1.12	0.71	-0.37	Step hazard
		1.41	1.19	0.75	-0.34	Step hazard
		1.41	1.19	0.75	-0.34	Step hazard
29	35.12	1.37	1.12	0.79	-0.36	Step hazard
		1.41	1.15	0.81	-0.34	Step hazard
		1.62	1.32	0.93	-0.02	Step hazard
30	37.93	1.37	1.08	0.84	-0.37	Step hazard
		1.75	1.38	1.08	-0.05	Crosspath hazard
31	40.74	N O H A Z A R D S C A T A L O G E D				
32	43.55	N O H A Z A R D S C A T A L O G E D				

Input file: MDL.PATH.11
File Creation Date : WED, AUG 10 1983   System time   19:22:52

** MODEL1 PARAMETERS **

HEIGHT FILTER COEFFICIENT :   0.25
SLOPE FILTER COEFFICIENT :   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

```
2.0 +                        ..
    |                           ..
    |            5             ..
1.0 +          4   4.          ..
    |        44  4          ..
    |    ..  4444444    4      ..
    |                            .
0.0 +                            .
    |                            .
    |    445444    4    4       ..
    |    44    5 ..        5   ..
-1.0 +        44 4              ..
    |                        ..
    |        ..              ..
-2.0 +          ..
    ------------------------------------> X
    0        1        2        3        4
```

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

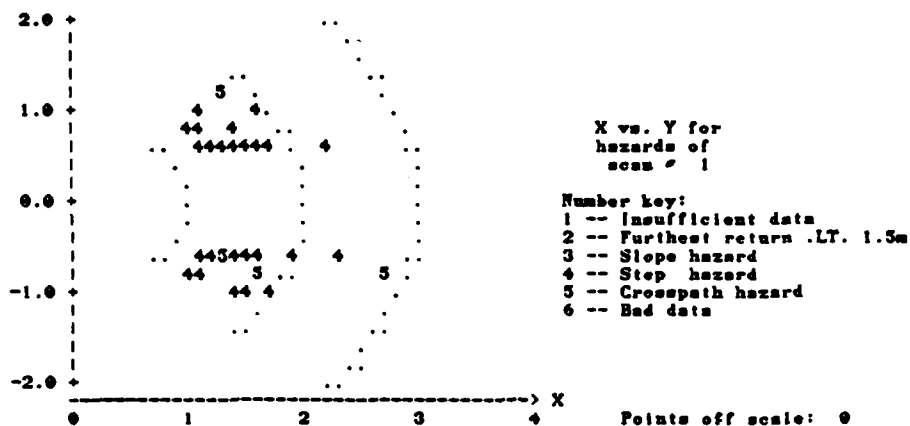| AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	NO	HAZARDS	CATALOGED		
2	-40.74	1.33	1.00	-0.86	-0.38	Step hazard
3	-37.93	1.33	1.05	-0.81	-0.38	Step hazard
4	-35.13	1.29	1.05	-0.74	-0.37	Step hazard
		1.29	1.03	-0.74	-0.37	Step hazard
		1.37	1.12	-0.79	-0.28	Step hazard
		1.63	1.35	-0.95	0.02	Step hazard
5	-32.31	1.29	1.09	-0.69	-0.37	Step hazard
		1.29	1.09	-0.69	-0.37	Step hazard
		1.33	1.12	-0.71	-0.37	Step hazard
		1.72	1.43	-0.92	0.01	Step hazard
6	-29.50	1.33	1.15	-0.65	-0.38	Step hazard
		1.33	1.15	-0.65	-0.38	Step hazard
		1.33	1.15	-0.65	-0.38	Step hazard
		1.33	1.15	-0.65	-0.38	Step hazard
		1.96	1.70	-0.96	0.00	Step hazard
7	-26.69	1.33	1.18	-0.60	-0.38	Step hazard
		1.33	1.18	-0.60	-0.38	Step hazard
		1.37	1.22	-0.61	-0.36	Step hazard
		1.41	1.26	-0.63	-0.34	Step hazard
		1.41	1.26	-0.63	-0.34	Step hazard
		1.50	1.34	-0.67	0.03	Crosspath hazard
8	-23.88	1.51	1.38	-0.61	-0.25	Step hazard
		1.75	1.60	-0.71	0.00	Crosspath hazard
9	-21.08	1.61	1.51	-0.58	-0.38	Step hazard
		1.61	1.51	-0.58	-0.38	Step hazard
		1.64	1.53	-0.59	-0.37	Step hazard
		1.71	1.60	-0.61	-0.31	Step hazard
10	-18.26	1.97	1.87	-0.62	-0.20	Step hazard
11	-15.45	2.34	2.25	-0.62	-0.22	Step hazard
		2.73	2.65	-0.73	-0.09	Crosspath hazard
12	-12.64	NO	HAZARDS	CATALOGED		
13	-9.84	NO	HAZARDS	CATALOGED		
14	-7.02	NO	HAZARDS	CATALOGED		
15	-4.22	NO	HAZARDS	CATALOGED		
16	-1.41	NO	HAZARDS	CATALOGED		
17	1.40	NO	HAZARDS	CATALOGED		
18	4.21	NO	HAZARDS	CATALOGED		
19	7.02	NO	HAZARDS	CATALOGED		
20	9.83	NO	HAZARDS	CATALOGED		
21	12.64	NO	HAZARDS	CATALOGED		
22	15.45	2.29	2.21	0.61	-0.36	Step hazard
23	18.26	NO	HAZARDS	CATALOGED		
24	21.07	1.86	1.73	0.67	-0.39	Step hazard
25	23.88	1.56	1.43	0.63	-0.32	Step hazard
		1.64	1.50	0.66	-0.35	Step hazard
		1.64	1.50	0.66	-0.35	Step hazard
		1.71	1.56	0.69	-0.31	Step hazard
26	26.69	1.41	1.26	0.63	-0.34	Step hazard
		1.56	1.40	0.70	-0.32	Step hazard
27	29.50	1.33	1.15	0.65	-0.38	Step hazard
		1.41	1.22	0.69	-0.34	Step hazard
28	32.31	1.29	1.09	0.69	-0.37	Step hazard
		1.29	1.09	0.69	-0.37	Step hazard
		1.33	1.12	0.71	-0.37	Step hazard
		1.88	1.59	1.00	0.00	Step hazard
29	35.12	1.29	1.05	0.74	-0.37	Step hazard
		1.33	1.08	0.76	-0.37	Step hazard
		1.41	1.15	0.81	-0.34	Step hazard
30	37.93	1.33	1.05	0.81	-0.38	Step hazard
		1.41	1.11	0.86	-0.34	Step hazard
31	40.74	1.37	1.03	0.89	-0.37	Step hazard
		1.41	1.07	0.92	-0.34	Step hazard
		1.73	1.33	1.14	-0.02	Crosspath hazard
32	43.55	NO	HAZARDS	CATALOGED		

```
Input file: MDL.PATH.12
File Creation Date : WED, AUG 10 1983      System time   19:17:03

              == MODEL1 PARAMETERS ==
     HEIGHT FILTER COEFFICIENT =        0.25
     SLOPE FILTER COEFFICIENT =         0.90
     LEVEL GROUND STEP THRESHOLD =      0.25 METERS
     SLOPE THRESHOLD =                 30.00 DEGREES
```
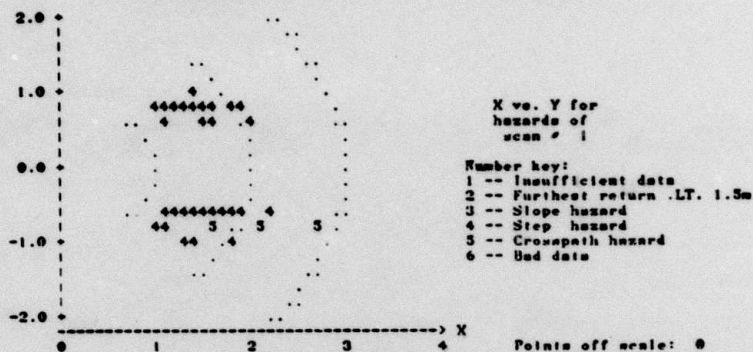


```
                                            X vs. Y for
                                            hazards of
                                            scan # 1

                                            Number key:
                                            1 -- Insufficient data
                                            2 -- Furthest return .LT. 1.5m
                                            3 -- Slope hazard
                                            4 -- Step  hazard
                                            5 -- Crosspath hazard
                                            6 -- Bad data

                                            Points off scale:  0
```

```
AZIMUTH  (deg)  RANGE   X      Y      Z     HAZARD TYPE
  1     -43.56   N O  H A Z A R D S  C A T A L O G E D
  2     -40.74   1.33   1.09   -0.86  -0.38  Step hazard
  3     -37.93   1.29   1.02   -0.79  -0.37  Step hazard
                 1.33   1.05   -0.81  -0.37  Step hazard
                 1.41   1.11   -0.86  -0.34  Step hazard
                 1.65   1.30   -1.02   0.01  Step hazard
  4     -35.13   1.29   1.03   -0.74  -0.37  Step hazard
                 1.29   1.03   -0.74  -0.37  Step hazard
                 1.29   1.03   -0.74  -0.37  Step hazard
                 1.32   1.08   -0.76  -0.30  Step hazard
                 1.72   1.40   -0.99   0.01  Step hazard
  5     -32.31   1.29   1.09   -0.69  -0.37  Step hazard
                 1.29   1.09   -0.69  -0.37  Step hazard
                 1.29   1.09   -0.69  -0.37  Step hazard
                 1.33   1.12   -0.71  -0.37  Step hazard
  6     -29.50   1.33   1.15   -0.65  -0.38  Step hazard
                 1.33   1.15   -0.63  -0.38  Step hazard
                 1.33   1.15   -0.63  -0.38  Step hazard
                 1.41   1.22   -0.69  -0.34  Step hazard
                 1.41   1.22   -0.69  -0.34  Step hazard
                 2.06   1.80   -1.02   0.02  Step hazard
  7     -26.69   1.33   1.18   -0.60  -0.37  Step hazard
                 1.41   1.26   -0.63  -0.34  Step hazard
                 1.41   1.26   -0.63  -0.34  Step hazard
                 1.48   1.32   -0.66  -0.29  Step hazard
                 1.75   1.56   -0.79   0.00  Crosspath hazard
  8     -23.88   1.56   1.43   -0.63  -0.32  Step hazard
                 1.64   1.50   -0.66  -0.35  Step hazard
                 1.64   1.50   -0.66  -0.35  Step hazard
                 1.71   1.56   -0.69  -0.31  Step hazard
  9     -21.08   1.86   1.73   -0.67  -0.37  Step hazard
                 2.25   2.10   -0.81   0.02  Crosspath hazard
 10     -18.26   1.86   1.76   -0.53  -0.39  Step hazard
                 1.97   1.87   -0.62  -0.20  Step hazard
 11     -15.45   2.29   2.21   -0.61  -0.36  Step hazard
                 2.75   2.65   -0.73  -0.09  Crosspath hazard
 12     -12.64   N O  H A Z A R D S  C A T A L O G E D
 13      -9.84   N O  H A Z A R D S  C A T A L O G E D
 14      -7.02   N O  H A Z A R D S  C A T A L O G E D
 15      -4.22   N O  H A Z A R D S  C A T A L O G E D
 16      -1.41   N O  H A Z A R D S  C A T A L O G E D
 17       1.40   N O  H A Z A R D S  C A T A L O G E D
 18       4.21   N O  H A Z A R D S  C A T A L O G E D
 19       7.02   N O  H A Z A R D S  C A T A L O G E D
 20       9.83   N O  H A Z A R D S  C A T A L O G E D
 21      12.64   N O  H A Z A R D S  C A T A L O G E D
 22      15.45   N O  H A Z A R D S  C A T A L O G E D
 23      18.26   2.09   1.98    0.65  -0.37  Step hazard
                 2.16   2.03    0.68  -0.18  Step hazard
 24      21.07   1.97   1.84    0.71  -0.20  Step hazard
                 2.04   1.90    0.73  -0.06  Step hazard
 25      23.88   1.61   1.48    0.65  -0.38  Step hazard
                 1.71   1.56    0.69  -0.31  Step hazard
                 1.77   1.61    0.71  -0.19  Step hazard
 26      26.69   1.61   1.44    0.72  -0.38  Step hazard
                 1.64   1.47    0.74  -0.37  Step hazard
 27      29.50   1.45   1.26    0.71  -0.32  Step hazard
                 1.51   1.32    0.74  -0.23  Step hazard
 28      32.31   1.29   1.09    0.69  -0.37  Step hazard
                 1.33   1.12    0.71  -0.37  Step hazard
                 1.41   1.19    0.73  -0.34  Step hazard
                 1.41   1.19    0.73  -0.34  Step hazard
 29      35.12   1.29   1.03    0.74  -0.37  Step hazard
                 1.29   1.03    0.74  -0.37  Step hazard
                 1.33   1.08    0.76  -0.37  Step hazard
 30      37.93   1.33   1.05    0.81  -0.38  Step hazard
                 1.41   1.11    0.86  -0.34  Step hazard
                 1.72   1.35    1.05   0.00  Step hazard
 31      40.74   1.33   1.09    0.86  -0.38  Step hazard
 32      43.55   N O  H A Z A R D S  C A T A L O G E D
```

Input file: MDL.PATH.13
File Creation Date : WED. AUG 10 1983   System time   19:12:48
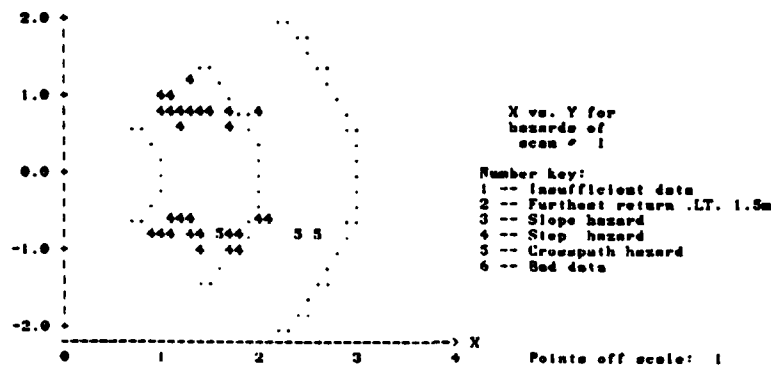
MODEL1 PARAMETERS
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 1

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.36	1.29	0.93	-0.89	-0.37	Step hazard
2	-40.74	1.29	0.96	-0.84	-0.37	Step hazard
		1.37	1.03	-0.89	-0.28	Step hazard
		1.37	1.03	-0.89	-0.28	Step hazard
3	-37.93	0.00	0.00	0.00	0.74	Step hazard
		1.72	1.33	-1.06	0.00	Step hazard
4	-35.13	1.33	1.03	-0.76	-0.38	Step hazard
		1.33	1.03	-0.76	-0.38	Step hazard
		1.33	1.03	-0.76	-0.38	Step hazard
		1.33	1.03	-0.76	-0.38	Step hazard
5	-32.31	1.29	1.09	-0.69	-0.37	Step hazard
		1.29	1.09	-0.69	-0.37	Step hazard
		1.33	1.12	-0.71	-0.37	Step hazard
		1.50	1.27	-0.80	0.04	Crosspath hazard
		1.96	1.63	-1.03	0.00	Step hazard
6	-29.50	1.33	1.13	-0.63	-0.37	Step hazard
		1.37	1.19	-0.67	-0.36	Step hazard
		1.41	1.22	-0.69	-0.34	Step hazard
		1.48	1.29	-0.73	-0.29	Step hazard
		2.06	1.80	-1.02	0.02	Step hazard
7	-26.69	1.41	1.26	-0.63	-0.34	Step hazard
		1.56	1.40	-0.70	-0.32	Step hazard
		1.73	1.56	-0.79	0.00	Crosspath hazard
8	-23.88	1.84	1.68	-0.74	-0.11	Step hazard
9	-21.08	1.97	1.84	-0.71	-0.20	Step hazard
10	-18.26	2.09	1.98	-0.63	-0.37	Step hazard
		2.20	2.09	-0.69	-0.08	Step hazard
		2.50	2.37	-0.73	0.03	Crosspath hazard
		2.73	2.61	-0.86	-0.03	Crosspath hazard
11	-15.45	NO	HAZARDS	CATALOGED		
12	-12.64	NO	HAZARDS	CATALOGED		
13	-9.84	NO	HAZARDS	CATALOGED		
14	-7.02	NO	HAZARDS	CATALOGED		
15	-4.22	NO	HAZARDS	CATALOGED		
16	-1.41	NO	HAZARDS	CATALOGED		
17	1.40	NO	HAZARDS	CATALOGED		
18	4.21	NO	HAZARDS	CATALOGED		
19	7.02	NO	HAZARDS	CATALOGED		
20	9.83	NO	HAZARDS	CATALOGED		
21	12.64	NO	HAZARDS	CATALOGED		
22	15.45	NO	HAZARDS	CATALOGED		
23	18.26	NO	HAZARDS	CATALOGED		
24	21.07	1.86	1.73	0.67	-0.39	Step hazard
		2.14	1.99	0.77	-0.34	Step hazard
25	23.88	1.86	1.70	0.73	-0.39	Step hazard
26	26.69	1.61	1.44	0.72	-0.30	Step hazard
		1.64	1.47	0.74	-0.37	Step hazard
		1.71	1.53	0.77	-0.31	Step hazard
27	29.50	1.41	1.22	0.69	-0.34	Step hazard
		1.48	1.29	0.73	-0.29	Step hazard
		1.61	1.40	0.79	-0.30	Step hazard
28	32.31	1.45	1.22	0.77	-0.32	Step hazard
		1.51	1.28	0.81	-0.25	Step hazard
29	35.12	1.37	1.12	0.79	-0.36	Step hazard
		1.41	1.13	0.81	-0.34	Step hazard
30	37.93	1.29	1.02	0.79	-0.37	Step hazard
		1.29	1.02	0.79	-0.37	Step hazard
		1.29	1.02	0.79	-0.37	Step hazard
		1.33	1.05	0.81	-0.37	Step hazard
31	40.74	1.33	1.00	0.86	-0.37	Step hazard
		1.41	1.07	0.92	-0.34	Step hazard
		1.41	1.07	0.92	-0.34	Step hazard
		1.72	1.30	1.12	0.01	Step hazard
32	43.55	1.37	0.99	0.94	-0.37	Step hazard
		1.41	1.02	0.97	-0.34	Step hazard

Input file: MDL.PATH.14.
File Creation Date : WED. AUG 10 1983   System time   19:07:04

```
            == MODEL1 PARAMETERS ==
    HEIGHT FILTER COEFFICIENT =          0.25
    SLOPE FILTER COEFFICIENT =           0.90
    LEVEL GROUND STEP THRESHOLD =        0.25 METERS
    SLOPE THRESHOLD =                    30.00 DEGREES
```


X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	1.37	0.99	-0.94	-0.37	Step hazard
		1.37	0.99	-0.94	-0.37	Step hazard
		1.37	0.99	-0.94	-0.37	Step hazard
2	-40.74	1.29	0.98	-0.84	-0.37	Step hazard
		1.29	0.98	-0.84	-0.37	Step hazard
		1.29	0.98	-0.84	-0.37	Step hazard
		1.72	1.30	-1.12	0.01	Step hazard
3	-37.93	1.29	1.02	-0.79	-0.37	Step hazard
		1.29	1.02	-0.79	-0.37	Step hazard
		1.29	1.02	-0.79	-0.37	Step hazard
		1.32	1.04	-0.81	-0.30	Step hazard
		1.76	1.39	-1.08	0.07	Step hazard
4	-35.13	1.33	1.08	-0.76	-0.37	Step hazard
		1.41	1.13	-0.81	-0.34	Step hazard
		1.41	1.13	-0.81	-0.34	Step hazard
		1.96	1.60	-1.13	0.00	Step hazard
5	-32.31	1.33	1.12	-0.71	-0.38	Step hazard
		1.58	1.23	-0.79	-0.29	Step hazard
6	-29.50	1.56	1.36	-0.77	-0.32	Step hazard
		1.64	1.43	-0.81	-0.35	Step hazard
		1.64	1.43	-0.81	-0.35	Step hazard
7	-26.69	1.61	1.44	-0.72	-0.38	Step hazard
		1.61	1.44	-0.72	-0.38	Step hazard
		1.64	1.47	-0.74	-0.37	Step hazard
		1.71	1.53	-0.77	-0.31	Step hazard
8	-23.88	1.86	1.70	-0.75	-0.39	Step hazard
9	-21.08	N O H A Z A R D S C A T A L O G E D				
10	-18.26	2.75	2.61	-0.86	-0.07	Crosspath hazard
11	-15.43	N O H A Z A R D S C A T A L O G E D				
12	-12.64	N O H A Z A R D S C A T A L O G E D				
13	-9.84	N O H A Z A R D S C A T A L O G E D				
14	-7.02	N O H A Z A R D S C A T A L O G E D				
15	-4.22	N O H A Z A R D S C A T A L O G E D				
16	-1.41	N O H A Z A R D S C A T A L O G E D				
17	1.40	N O H A Z A R D S C A T A L O G E D				
18	4.21	N O H A Z A R D S C A T A L O G E D				
19	7.02	N O H A Z A R D S C A T A L O G E D				
20	9.83	N O H A Z A R D S C A T A L O G E D				
21	12.64	N O H A Z A R D S C A T A L O G E D				
22	15.43	N O H A Z A R D S C A T A L O G E D				
23	18.26	N O H A Z A R D S C A T A L O G E D				
24	21.07	2.18	2.03	0.78	-0.14	Step hazard
		2.25	2.10	0.81	-0.02	Crosspath hazard
		2.29	2.14	0.82	-0.28	Step hazard
25	23.88	1.86	1.70	0.75	-0.39	Step hazard
		1.86	1.70	0.75	-0.39	Step hazard
26	26.69	1.86	1.66	0.83	-0.37	Step hazard
27	29.50	1.61	1.40	0.79	-0.38	Step hazard
		1.61	1.40	0.79	-0.38	Step hazard
		1.64	1.43	0.81	-0.37	Step hazard
		1.71	1.49	0.84	-0.31	Step hazard
28	32.31	1.29	1.09	0.69	-0.37	Step hazard
		1.41	1.19	0.75	-0.34	Step hazard
		1.41	1.19	0.75	-0.34	Step hazard
		1.48	1.25	0.79	-0.29	Step hazard
29	35.12	1.33	1.08	0.76	-0.38	Step hazard
		2.04	1.66	1.17	-0.01	Step hazard
30	37.93	1.33	1.05	0.81	-0.38	Step hazard
		1.41	1.11	0.86	-0.34	Step hazard
		1.41	1.11	0.86	-0.34	Step hazard
31	40.74	1.29	0.98	0.84	-0.37	Step hazard
		1.29	0.98	0.84	-0.37	Step hazard
		1.33	1.00	0.86	-0.37	Step hazard
32	43.55	1.33	0.96	0.91	-0.37	Step hazard
		1.41	1.02	0.97	-0.34	Step hazard
		1.41	1.02	0.97	-0.34	Step hazard
		1.72	1.24	1.18	0.01	Step hazard

Input file: MDL.PATH.15
File Creation Date : WED, AUG 10 1983   System time   19:01:57

```
        ==  MODEL: PARAMETERS  ==
        HEIGHT FILTER COEFFICIENT =        0.25
        SLOPE FILTER COEFFICIENT =         0.90
        LEVEL GROUND STEP THRESHOLD =      0.25 METERS
        SLOPE THRESHOLD =                 30.00 DEGREES
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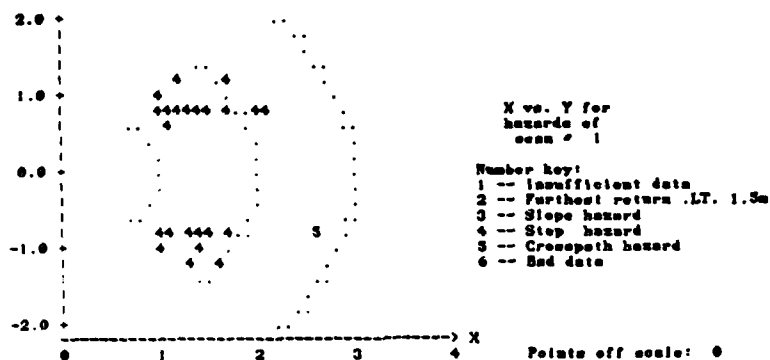

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE		Y	Z	HAZARD TYPE
1	-43.56	1.29	0.93	-0.89	-0.37	Step hazard
		1.29	0.93	-0.89	-0.37	Step hazard
		1.29	0.93	-0.89	-0.37	Step hazard
		1.72	1.24	-1.18	0.01	Step hazard
2	-40.74	1.33	1.00	-0.86	-0.38	Step hazard
		1.33	1.00	-0.86	-0.38	Step hazard
		1.33	1.00	-0.86	-0.38	Step hazard
3	-37.93	1.33	1.05	-0.81	-0.38	Step hazard
		1.41	1.11	-0.86	-0.34	Step hazard
		1.41	1.11	-0.86	-0.34	Step hazard
4	-35.13	1.33	1.08	-0.76	-0.37	Step hazard
		1.37	1.12	-0.79	-0.36	Step hazard
		1.41	1.15	-0.81	-0.34	Step hazard
		1.48	1.21	-0.85	-0.29	Step hazard
5	-32.31	1.41	1.19	-0.75	-0.34	Step hazard
		1.41	1.19	-0.75	-0.34	Step hazard
		1.48	1.25	-0.79	-0.29	Step hazard
		1.73	1.48	-0.94	0.00	Crosspath hazard
6	-29.50	1.61	1.40	-0.79	-0.38	Step hazard
		1.64	1.43	-0.81	-0.37	Step hazard
		1.71	1.49	-0.84	-0.31	Step hazard
7	-26.69	1.86	1.66	-0.83	-0.39	Step hazard
8	-23.88	2.04	1.86	-0.82	-0.26	Step hazard
		2.12	1.94	-0.86	-0.28	Step hazard
9	-21.08	2.75	2.57	-0.99	-0.07	Crosspath hazard
10	-18.26	0	H A Z A R D S	C A T A L O G E D		
11	-15.45	0	H A Z A R D S	C A T A L O G E D		
12	-12.64	0	H A Z A R D S	C A T A L O G E D		
13	-9.84	0	H A Z A R D S	C A T A L O G E D		
14	-7.02	0	H A Z A R D S	C A T A L O G E D		
15	-4.22	0	H A Z A R D S	C A T A L O G E D		
16	-1.41	0	H A Z A R D S	C A T A L O G E D		
17	1.40	0	H A Z A R D S	C A T A L O G E D		
18	4.21	0	H A Z A R D S	C A T A L O G E D		
19	7.02	0	H A Z A R D S	C A T A L O G E D		
20	9.83	0	H A Z A R D S	C A T A L O G E D		
21	12.64	0	H A Z A R D S	C A T A L O G E D		
22	15.45	0	H A Z A R D S	C A T A L O G E D		
23	18.26	0	H A Z A R D S	C A T A L O G E D		
24	21.07	0	H A Z A R D S	C A T A L O G E D		
25	23.93	2.39	1.91	0.84	-0.37	Step hazard
		2.99	1.91	0.84	-0.37	Step hazard
		3.20	2.01	0.89	-0.08	Step hazard
26	26.69	1.86	1.66	0.83	-0.39	Step hazard
		2.00	1.79	0.90	-0.35	Step hazard
27	29.50	1.66	1.61	0.91	-0.37	Step hazard
		1.66	1.61	0.91	-0.37	Step hazard
28	32.31	1.61	1.56	0.86	-0.38	Step hazard
		1.84	1.53	0.98	-0.13	Step hazard
29	35.12	1.29	1.05	0.74	-0.37	Step hazard
		1.41	1.15	0.81	-0.34	Step hazard
		1.41	1.15	0.81	-0.34	Step hazard
		1.48	1.21	0.85	-0.29	Step hazard
		2.06	1.69	1.19	0.02	Step hazard
30	37.93	1.33	1.05	0.81	-0.38	Step hazard
		1.48	1.17	0.91	-0.29	Step hazard
		2.04	1.61	1.25	-0.01	Step hazard
31	40.74	1.33	1.00	0.86	-0.38	Step hazard
		1.41	1.07	0.92	-0.34	Step hazard
		1.88	1.42	1.23	0.00	Step hazard
32	43.55	1.29	0.93	0.89	-0.37	Step hazard
		1.29	0.93	0.89	-0.37	Step hazard
		1.33	0.96	0.91	-0.37	Step hazard

7.2.5 Range Test Results

Input file: MDL.RANGE.04
File Creation Date : WED, AUG 10 1983   System time   20:56:29

```
            **   MODEL1 PARAMETERS   **
       HEIGHT FILTER COEFFICIENT =        0.25
       SLOPE FILTER COEFFICIENT  =        0.90
       LEVEL GROUND STEP THRESHOLD =      0.25 METERS
       SLOPE THRESHOLD =                 30.00 DEGREES
```
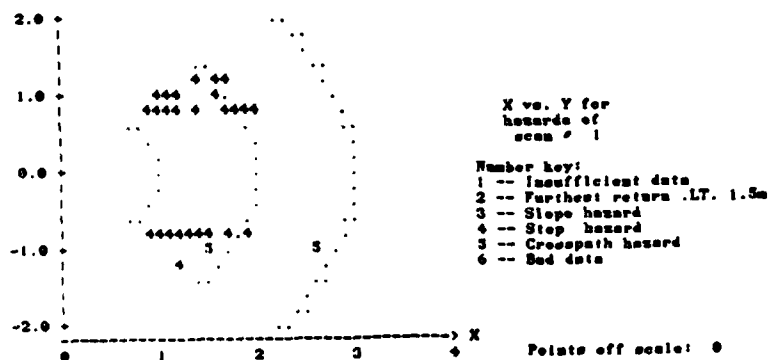

X vs. Y for
hazards of
  scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

NO HAZARDS CATALOGED THIS SCAN

Input file: MDL.RANGE.05
File Creation Date : WED, AUG 10 1983   System time   20:54:20

** MODEL1 PARAMETERS **

HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	1.06	1.05	-0.08	0.01	Step hazard
16	-1.41	1.06	1.06	-0.03	0.01	Step hazard
17	1.40	1.06	1.06	0.03	0.01	Step hazard
18	4.21	1.06	1.05	0.08	0.01	Step hazard
19	7.02	1.06	1.05	0.13	0.01	Step hazard
20	9.83	1.06	1.04	0.18	0.01	Step hazard
21	12.64	1.06	1.03	0.23	0.01	Step hazard
22	15.45	1.10	1.06	0.29	0.00	Step hazard
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.RANGE.06
File Creation Date : WED, AUG 10 1983   System time   20:51:49

** MODEL1 PARAMETERS **

HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	N O	H A Z A R D S	C A T A L O G E D		
16	-1.41	N O	H A Z A R D S	C A T A L O G E D		
17	1.40	N O	H A Z A R D S	C A T A L O G E D		
18	4.21	N O	H A Z A R D S	C A T A L O G E D		
19	7.02	N O	H A Z A R D S	C A T A L O G E D		
20	9.83	N O	H A Z A R D S	C A T A L O G E D		
21	12.64	1.17	1.14	0.26	0.05	Step hazard
22	15.45	1.20	1.16	0.32	-0.02	Step hazard
23	18.26	1.06	1.00	0.33	0.01	Step hazard
		1.25	1.19	0.39	0.01	Crosspath hazard
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.RANGE.07
File Creation Date : WED, AUG 10 1983   System time   20:47:50

** MODEL1 PARAMETERS **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

```
 2.0 +                        . .
     |                          . .
     |                            .
     |                     . .          . .
     |                                    .
 1.0 +                    .            .
     |                                    .
     |          . .          . .           .
     |             .4                        .
     |              . 4         .            .
 0.0 +              . 4         .            .
     |                          .            .
     |            . .           .          . .
     |                          .
     |                     . .          . .
-1.0 +                                    .
     |              . .                  .
     |                 .          .         .
     |                    . .          . .
     |
-2.0 +            •            . .
     -------------------------------------> X
      0         1         2         3         4      Points off scale:  0
```

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

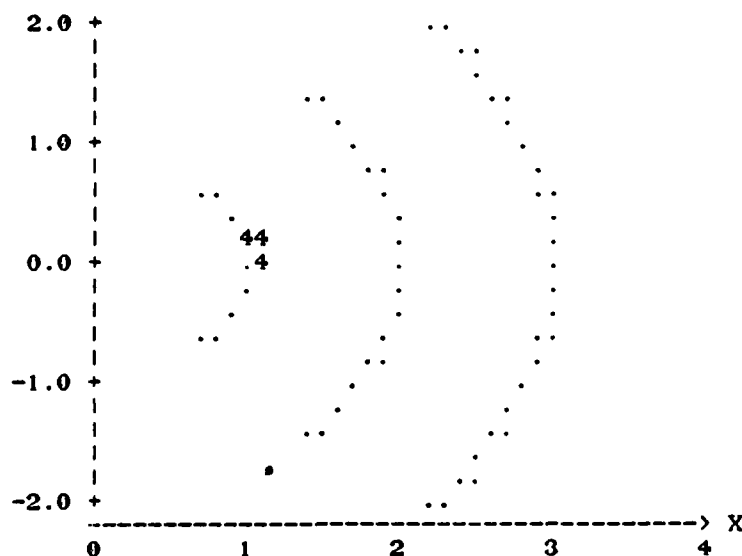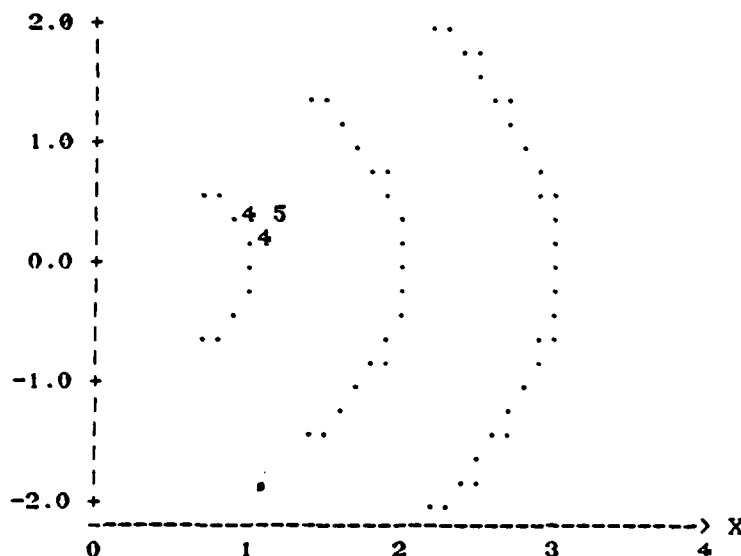| AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	N O	H A Z A R D S	C A T A L O G E D		
16	-1.41	N O	H A Z A R D S	C A T A L O G E D		
17	1.40	N O	H A Z A R D S	C A T A L O G E D		
18	4.21	1.22	1.22	0.09	0.02	Step hazard
19	7.02	N O	H A Z A R D S	C A T A L O G E D		
20	9.83	1.26	1.24	0.21	0.02	Step hazard
21	12.64	1.26	1.23	0.28	0.02	Step hazard
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	1.06	1.00	0.33	0.01	Step hazard
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.RANGE.08
File Creation Date : WED, AUG 10 1983   System time   20:40:26

**   MODEL1 PARAMETERS   **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

```
2.0 +                              . .
    |                                 . .
    |                                   .
    |                              . .
    |                                  .
1.0 +                        .            .
    |                                            X vs. Y for
    |                   . .      .         . .    hazards of
    |              . .      4 5         .           scan #  1
    |              .      44          .
0.0 +              .      44        .          Number key:
    |                                          1 -- Insufficient data
    |                                          2 -- Furthest return .LT. 1.5m
    |                                          3 -- Slope hazard
    |              . .      .         . .      4 -- Step  hazard
    |                      . .      .          5 -- Crosspath hazard
-1.0 +                    .           .        6 -- Bad data
    |                        .       .
    |                     . .      . .
    |
    |                    .          . .
-2.0 +                        . .
    ------------------------------------------> X
    0         1         2         3         4      Points off scale:  0
```

```
AZIMUTH  (deg)   RANGE       X          Y          Z      HAZARD TYPE
   1    -43.56   N O   H A Z A R D S   C A T A L O G E D
   2    -40.74   N O   H A Z A R D S   C A T A L O G E D
   3    -37.93   N O   H A Z A R D S   C A T A L O G E D
   4    -35.13   N O   H A Z A R D S   C A T A L O G E D
   5    -32.31   N O   H A Z A R D S   C A T A L O G E D
   6    -29.50   N O   H A Z A R D S   C A T A L O G E D
   7    -26.69   N O   H A Z A R D S   C A T A L O G E D
   8    -23.88   N O   H A Z A R D S   C A T A L O G E D
   9    -21.08   N O   H A Z A R D S   C A T A L O G E D
  10    -18.26   N O   H A Z A R D S   C A T A L O G E D
  11    -15.45   N O   H A Z A R D S   C A T A L O G E D
  12    -12.64   N O   H A Z A R D S   C A T A L O G E D
  13     -9.84   N O   H A Z A R D S   C A T A L O G E D
  14     -7.02   N O   H A Z A R D S   C A T A L O G E D
  15     -4.22   N O   H A Z A R D S   C A T A L O G E D
  16     -1.41   1.33       1.33      -0.03      -0.01     Step hazard
  17      1.40   1.37       1.37       0.03       0.00     Step hazard
  18      4.21   1.37       1.37       0.10       0.00     Step hazard
  19      7.02   1.37       1.36       0.17       0.00     Step hazard
  20      9.83   1.37       1.35       0.23       0.00     Step hazard
  21     12.64   N O   H A Z A R D S   C A T A L O G E D
  22     15.45   1.26       1.21       0.34       0.02     Step hazard
                 1.50       1.45       0.40       0.02     Crosspath hazard
  23     18.26   N O   H A Z A R D S   C A T A L O G E D
  24     21.07   N O   H A Z A R D S   C A T A L O G E D
  25     23.88   N O   H A Z A R D S   C A T A L O G E D
  26     26.69   N O   H A Z A R D S   C A T A L O G E D
  27     29.50   N O   H A Z A R D S   C A T A L O G E D
  28     32.31   N O   H A Z A R D S   C A T A L O G E D
  29     35.12   N O   H A Z A R D S   C A T A L O G E D
  30     37.93   N O   H A Z A R D S   C A T A L O G E D
  31     40.74   N O   H A Z A R D S   C A T A L O G E D
  32     43.55   N O   H A Z A R D S   C A T A L O G E D
```

Input file: MDL.RANGE.09
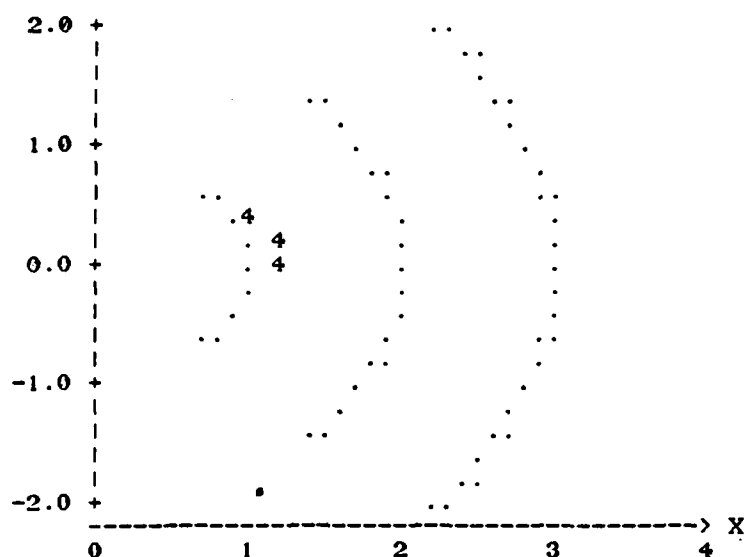File Creation Date : WED, AUG 10 1983   System time   20:45:23

```
                    **  MODEL1 PARAMETERS  **
        HEIGHT FILTER COEFFICIENT =        0.25
        SLOPE FILTER COEFFICIENT  =        0.90
        LEVEL GROUND STEP THRESHOLD =      0.25 METERS
        SLOPE THRESHOLD =                  30.00 DEGREES
```

```
  2.0 +                          ..
       |                           ..
       |                       .    .
       |                    ..        ..
       |                   .           .
  1.0 +                   .            .
       |                 ..      .      ..
       |               ..    .   5  .     .                X vs. Y for
       |               .        4       ..                 hazards of
  0.0 +               .        4          .                 scan #  1
       |               .       .           .
       |               .          .      .              Number key:
       |               ..      .          ..            1 -- Insufficient data
       |                                                2 -- Furthest return .LT. 1.5m
 -1.0 +               ..         .        .             3 -- Slope hazard
       |                 .          .    .              4 -- Step  hazard
       |                  .              .              5 -- Crosspath hazard
       |                  ..          ..                6 -- Bad data
       |                    .       ..
 -2.0 +                      ..
       +------------------------------------> X
       0        1        2        3        4            Points off scale:  0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S		C A T A L O G E D	
2	-40.74	N O	H A Z A R D S		C A T A L O G E D	
3	-37.93	N O	H A Z A R D S		C A T A L O G E D	
4	-35.13	N O	H A Z A R D S		C A T A L O G E D	
5	-32.31	N O	H A Z A R D S		C A T A L O G E D	
6	-29.50	N O	H A Z A R D S		C A T A L O G E D	
7	-26.69	N O	H A Z A R D S		C A T A L O G E D	
8	-23.88	N O	H A Z A R D S		C A T A L O G E D	
9	-21.08	N O	H A Z A R D S		C A T A L O G E D	
10	-18.26	N O	H A Z A R D S		C A T A L O G E D	
11	-15.45	N O	H A Z A R D S		C A T A L O G E D	
12	-12.64	N O	H A Z A R D S		C A T A L O G E D	
13	-9.84	N O	H A Z A R D S		C A T A L O G E D	
14	-7.02	N O	H A Z A R D S		C A T A L O G E D	
15	-4.22	N O	H A Z A R D S		C A T A L O G E D	
16	-1.41	N O	H A Z A R D S		C A T A L O G E D	
17	1.40	1.43	1.43	0.04	0.03	Step hazard
18	4.21	N O	H A Z A R D S		C A T A L O G E D	
19	7.02	1.43	1.42	0.18	0.03	Step hazard
20	9.83	1.43	1.41	0.24	0.04	Step hazard
21	12.64	N O	H A Z A R D S		C A T A L O G E D	
22	15.45	1.50	1.45	0.40	-0.03	Crosspath hazard
23	18.26	N O	H A Z A R D S		C A T A L O G E D	
24	21.07	N O	H A Z A R D S		C A T A L O G E D	
25	23.88	N O	H A Z A R D S		C A T A L O G E D	
26	26.69	N O	H A Z A R D S		C A T A L O G E D	
27	29.50	N O	H A Z A R D S		C A T A L O G E D	
28	32.31	N O	H A Z A R D S		C A T A L O G E D	
29	35.12	N O	H A Z A R D S		C A T A L O G E D	
30	37.93	N O	H A Z A R D S		C A T A L O G E D	
31	40.74	N O	H A Z A R D S		C A T A L O G E D	
32	43.55	N O	H A Z A R D S		C A T A L O G E D	

```
Input file: MDL.RANGE.10
File Creation Date : WED, AUG 10 1983      System time    19:33:11

                    **  MODEL1 PARAMETERS  **
           HEIGHT FILTER COEFFICIENT =          0.25
           SLOPE FILTER COEFFICIENT  =          0.90
           LEVEL GROUND STEP THRESHOLD =        0.25 METERS
           SLOPE THRESHOLD =                   30.00 DEGREES
```
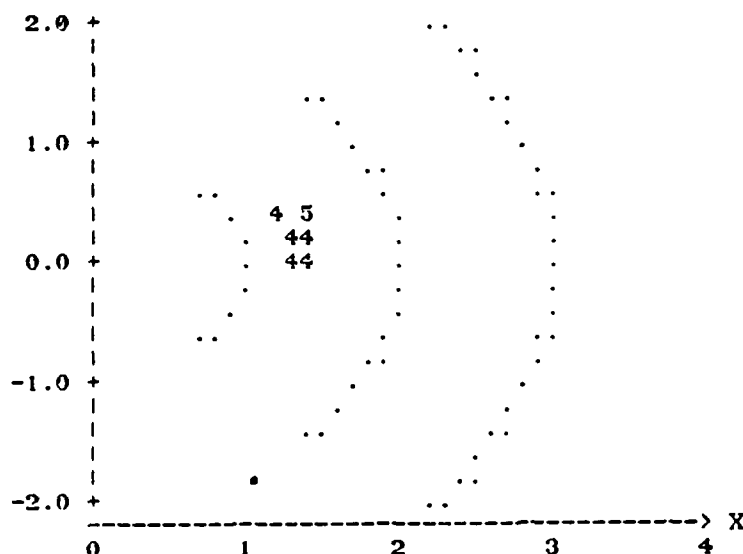
```
 2.0 +                        ..
     I
     I                   ..          ..
     I
 1.0 +                ..                            X vs. Y for
     I                                             hazards of
     I            ..        ..                       scan #  1
     I          .   4  4        .
 0.0 +          . 44    4   .           .         Number key:
     I                                            1 -- Insufficient data
     I                4                           2 -- Furthest return .LT. 1.5m
     I                                            3 -- Slope hazard
     I            ..        .                     4 -- Step  hazard
-1.0 +          .       .                         5 -- Crosspath hazard
     I                                            6 -- Bad data
     I                   ..
     I
-2.0 +                        ..
     +------------------------------------> X
     0       1       2       3       4           Points off scale:  0
              .
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	1.24	1.24	-0.09	-0.30	Step hazard
		1.24	1.24	-0.09	-0.30	Step hazard
		1.24	1.24	-0.09	-0.30	Step hazard
		1.55	1.55	-0.11	0.02	Step hazard
16	-1.41	1.24	1.24	-0.03	-0.30	Step hazard
		1.24	1.24	-0.03	-0.30	Step hazard
		1.24	1.24	-0.03	-0.30	Step hazard
17	1.40	1.55	1.55	0.04	-0.00	Step hazard
18	4.21	1.29	1.29	0.09	-0.36	Step hazard
		1.29	1.29	0.09	-0.36	Step hazard
		1.29	1.29	0.09	-0.36	Step hazard
		1.55	1.55	0.11	0.02	Step hazard
19	7.02	1.24	1.24	0.15	-0.30	Step hazard
		1.24	1.24	0.15	-0.30	Step hazard
		1.24	1.24	0.15	-0.30	Step hazard
20	9.83	N O	H A Z A R D S	C A T A L O G E D		
21	12.64	N O	H A Z A R D S	C A T A L O G E D		
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.RANGE.11
File Creation Date : WED, AUG 10 1983   System time   19:38:10
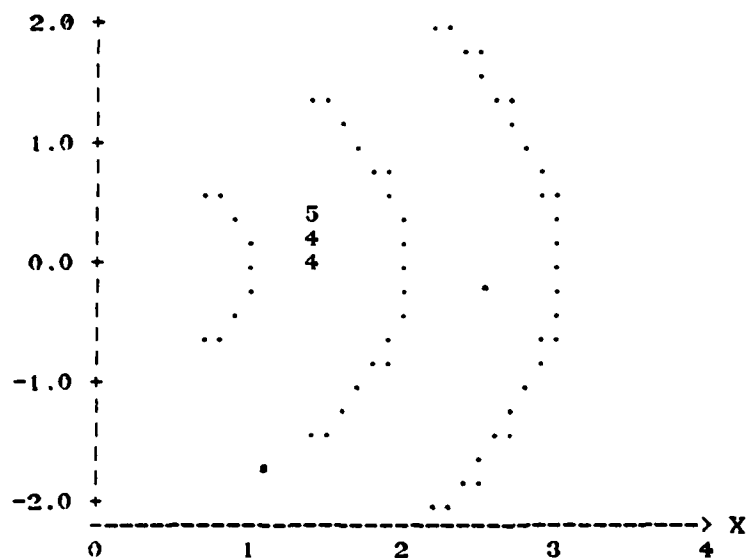
== MODEL1 PARAMETERS ==
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

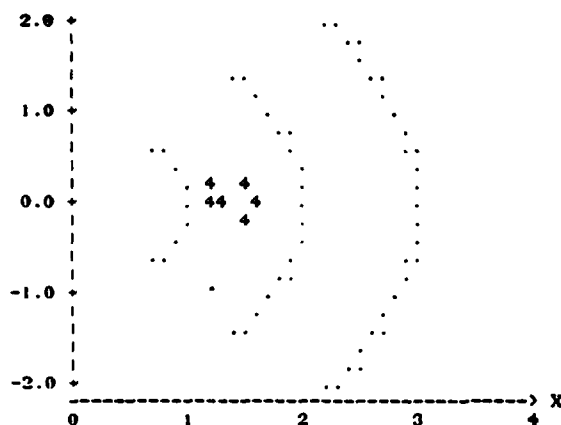| AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	NO HAZARDS CATALOGED				
2	-40.74	NO HAZARDS CATALOGED				
3	-37.93	NO HAZARDS CATALOGED				
4	-35.13	NO HAZARDS CATALOGED				
5	-32.31	NO HAZARDS CATALOGED				
6	-29.50	NO HAZARDS CATALOGED				
7	-26.69	NO HAZARDS CATALOGED				
8	-23.88	NO HAZARDS CATALOGED				
9	-21.08	NO HAZARDS CATALOGED				
10	-18.26	NO HAZARDS CATALOGED				
11	-15.45	NO HAZARDS CATALOGED				
12	-12.64	NO HAZARDS CATALOGED				
13	-9.84	NO HAZARDS CATALOGED				
14	-7.02	NO HAZARDS CATALOGED				
15	-4.22	1.37	1.36	-0.10	-0.37	Step hazard
		1.37	1.36	-0.10	-0.37	Step hazard
		1.37	1.36	-0.10	-0.37	Step hazard
16	-1.41	1.29	1.29	-0.03	-0.37	Step hazard
		1.29	1.29	-0.03	-0.37	Step hazard
		1.33	1.32	-0.03	-0.37	Step hazard
		1.63	1.65	-0.04	0.02	Step hazard
17	1.40	1.29	1.29	0.03	-0.37	Step hazard
		1.29	1.29	0.03	-0.37	Step hazard
		1.37	1.37	0.03	-0.36	Step hazard
		1.37	1.37	0.03	-0.36	Step hazard
18	4.21	1.29	1.29	0.09	-0.37	Step hazard
		1.29	1.29	0.09	-0.37	Step hazard
		1.33	1.32	0.10	-0.37	Step hazard
		1.65	1.65	0.12	0.02	Step hazard
19	7.02	1.33	1.32	0.16	-0.38	Step hazard
		1.33	1.32	0.16	-0.38	Step hazard
		1.33	1.32	0.16	-0.38	Step hazard
		1.65	1.64	0.20	0.01	Step hazard
20	9.83	1.29	1.27	0.22	-0.37	Step hazard
		1.29	1.27	0.22	-0.37	Step hazard
21	12.64	NO HAZARDS CATALOGED				
22	15.45	NO HAZARDS CATALOGED				
23	18.26	NO HAZARDS CATALOGED				
24	21.07	NO HAZARDS CATALOGED				
25	23.88	NO HAZARDS CATALOGED				
26	26.69	NO HAZARDS CATALOGED				
27	29.50	NO HAZARDS CATALOGED				
28	32.31	NO HAZARDS CATALOGED				
29	35.12	NO HAZARDS CATALOGED				
30	37.93	NO HAZARDS CATALOGED				
31	40.74	NO HAZARDS CATALOGED				
32	43.55	NO HAZARDS CATALOGED				

Input file: MDL.RANGE.12
File Creation Date : WED, AUG 10 1983   System time   19:40:52

```
                ** MODEL1 PARAMETERS **
     HEIGHT FILTER COEFFICIENT =        0.25
     SLOPE FILTER COEFFICIENT  =        0.90
     LEVEL GROUND STEP THRESHOLD =      0.25 METERS
     SLOPE THRESHOLD =                  30.00 DEGREES


 2.0 +
     I                              ..
     I                        ..          ..
     .                                        .
 1.0 +                    ..                        X vs. Y for
     I                                        .      hazards of
     I              ..            ..                 scan # 1
     .                         ..                 .
     .          444 5                           .  Number key:
 0.0 +          444 4            ..            .    1 -- Insufficient data
     I                                         .    2 -- Furthest return .LT. 1.5m
     I              ..                          .   3 -- Slope hazard
     .                         ..              .    4 -- Step  hazard
-1.0 +                    ..                        5 -- Crosspath hazard
     I                        ..          ..        6 -- Bad data
     I                              ..
     .
-2.0 +                         ..
     -------------------------------------------> X
     0         1         2         3         4      Points off scale:  0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	NO	H A Z A R D S	C A T A L O G E D		
2	-40.74	NO	H A Z A R D S	C A T A L O G E D		
3	-37.93	NO	H A Z A R D S	C A T A L O G E D		
4	-35.13	NO	H A Z A R D S	C A T A L O G E D		
5	-32.31	NO	H A Z A R D S	C A T A L O G E D		
6	-29.50	NO	H A Z A R D S	C A T A L O G E D		
7	-26.69	NO	H A Z A R D S	C A T A L O G E D		
8	-23.88	NO	H A Z A R D S	C A T A L O G E D		
9	-21.08	NO	H A Z A R D S	C A T A L O G E D		
10	-18.26	NO	H A Z A R D S	C A T A L O G E D		
11	-15.45	NO	H A Z A R D S	C A T A L O G E D		
12	-12.64	NO	H A Z A R D S	C A T A L O G E D		
13	-9.84	NO	H A Z A R D S	C A T A L O G E D		
14	-7.02	NO	H A Z A R D S	C A T A L O G E D		
15	-4.22	1.29	1.29	-0.09	-0.37	Step hazard
16	-1.41	1.33	1.32	-0.03	-0.37	Step hazard
		1.37	1.37	-0.03	-0.36	Step hazard
		1.41	1.41	-0.03	-0.34	Step hazard
		1.49	1.49	-0.04	-0.38	Step hazard
		1.72	1.72	-0.04	0.01	Step hazard
17	1.40	1.33	1.32	0.03	-0.38	Step hazard
		1.41	1.41	0.03	-0.34	Step hazard
		1.41	1.41	0.03	-0.34	Step hazard
		1.49	1.49	0.04	-0.38	Step hazard
18	4.21	1.33	1.32	0.10	-0.38	Step hazard
		1.41	1.40	0.10	-0.34	Step hazard
		1.48	1.48	0.11	-0.29	Step hazard
19	7.02	1.33	1.32	0.16	-0.37	Step hazard
		1.37	1.36	0.17	-0.36	Step hazard
		1.41	1.40	0.17	-0.34	Step hazard
		1.75	1.74	0.21	0.01	Crosspath hazard
20	9.83	NO	H A Z A R D S	C A T A L O G E D		
21	12.64	NO	H A Z A R D S	C A T A L O G E D		
22	15.45	NO	H A Z A R D S	C A T A L O G E D		
23	18.26	NO	H A Z A R D S	C A T A L O G E D		
24	21.07	NO	H A Z A R D S	C A T A L O G E D		
25	23.88	NO	H A Z A R D S	C A T A L O G E D		
26	26.69	NO	H A Z A R D S	C A T A L O G E D		
27	29.50	NO	H A Z A R D S	C A T A L O G E D		
28	32.31	NO	H A Z A R D S	C A T A L O G E D		
29	35.12	NO	H A Z A R D S	C A T A L O G E D		
30	37.93	NO	H A Z A R D S	C A T A L O G E D		
31	40.74	NO	H A Z A R D S	C A T A L O G E D		
32	43.55	NO	H A Z A R D S	C A T A L O G E D		

Input file: MDL.RANGE.13
File Creation Date : WED. AUG 10 1983   System time   19:43:35

```
                    ==  MODEL1 PARAMETERS  ==
            HEIGHT FILTER COEFFICIENT =          0.25
            SLOPE FILTER COEFFICIENT  =          0.90
            LEVEL GROUND STEP THRESHOLD =        0.25 METERS
            SLOPE THRESHOLD =                    30.00 DEGREES
```
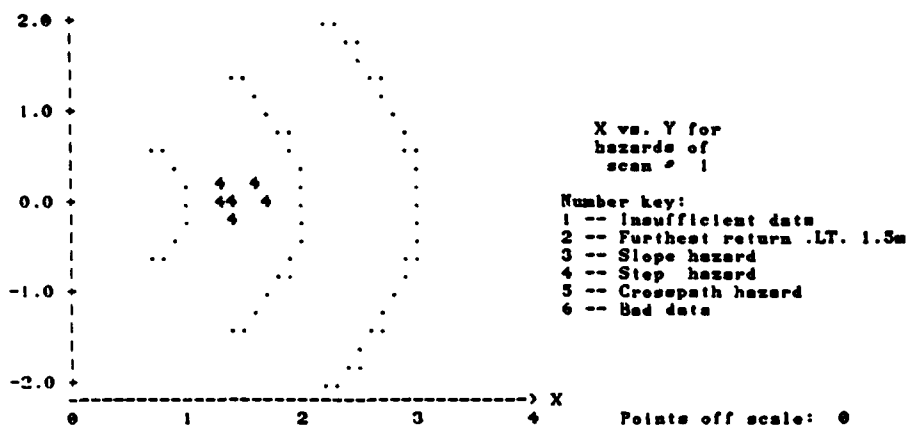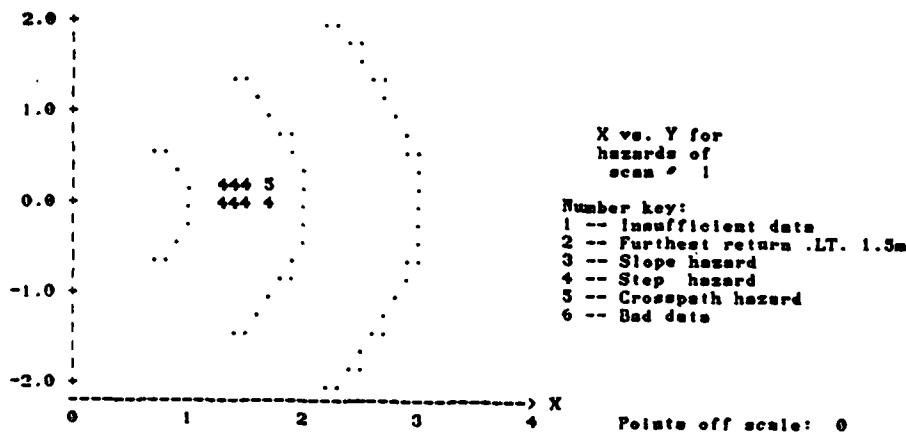

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A	L O G E D	
2	-40.74	· N O	H A Z A R D S	C A T A	L O G E D	
3	-37.93	● N O	H A Z A R D S	C A T A	L O G E D	
4	-35.13	N O	H A Z A R D S	C A T A	L O G E D	
5	-32.31	N O	H A Z A R D S	C A T A	L O G E D	
6	-29.50	N O	H A Z A R D S	C A T A	L O G E D	
7	-26.69	N O	H A Z A R D S	C A T A	L O G E D	
8	-23.88	N O	H A Z A R D S	C A T A	L O G E D	
9	-21.08	N O	H A Z A R D S	C A T A	L O G E D	
10	-18.26	N O	H A Z A R D S	C A T A	L O G E D	
11	-15.45	N O	H A Z A R D S	C A T A	L O G E D	
12	-12.64	N O	H A Z A R D S	C A T A	L O G E D	
13	-9.84	N O	H A Z A R D S	C A T A	L O G E D	
14	-7.02	N O	H A Z A R D S	C A T A	L O G E D	
15	-4.22	1.41	1.40	-0.10	-0.34	Step hazard
		1.41	1.40	-0.10	-0.34	Step hazard
		1.48	1.48	-0.11	-0.29	Step hazard
		1.72	1.71	-0.13	0.00	Step hazard
16	-1.41	1.37	1.37	-0.03	-0.36	Step hazard
		1.41	1.41	-0.03	-0.34	Step hazard
		1.48	1.48	-0.04	-0.29	Step hazard
		1.56	1.56	-0.04	-0.32	Step hazard
17	1.40	1.41	1.41	0.03	-0.34	Step hazard
		1.56	1.56	0.04	-0.32	Step hazard
18	4.21	1.41	1.40	0.10	-0.34	Step hazard
		1.56	1.56	0.11	-0.32	Step hazard
19	7.02	1.37	1.36	0.17	-0.36	Step hazard
		1.41	1.40	0.17	-0.34	Step hazard
		1.48	1.47	0.18	-0.29	Step hazard
		1.73	1.74	0.21	0.00	Crosspath hazard
20	9.83	N O	H A Z A R D S	C A T A	L O G E D	
21	12.64	N O	H A Z A R D S	C A T A	L O G E D	
22	15.45	N O	H A Z A R D S	C A T A	L O G E D	
23	18.26	N O	H A Z A R D S	C A T A	L O G E D	
24	21.07	N O	H A Z A R D S	C A T A	L O G E D	
25	23.88	N O	H A Z A R D S	C A T A	L O G E D	
26	26.69	N O	H A Z A R D S	C A T A	L O G E D	
27	29.50	N O	H A Z A R D S	C A T A	L O G E D	
28	32.31	N O	H A Z A R D S	C A T A	L O G E D	
29	35.12	N O	H A Z A R D S	C A T A	L O G E D	
30	37.93	N O	H A Z A R D S	C A T A	L O G E D	
31	40.74	N O	H A Z A R D S	C A T A	L O G E D	
32	43.55	N O	H A Z A R D S	C A T A	L O G E D	

Input file: MDL.RANGE.14
File Creation Date : WED, AUG 10 1983   System time   19:46:46

```
                    **  MODEL1 PARAMETERS  **
           HEIGHT FILTER COEFFICIENT  =          0.25
           SLOPE FILTER COEFFICIENT   =          0.90
           LEVEL GROUND STEP THRESHOLD =         0.25 METERS
           SLOPE THRESHOLD =                    30.00 DEGREES
```
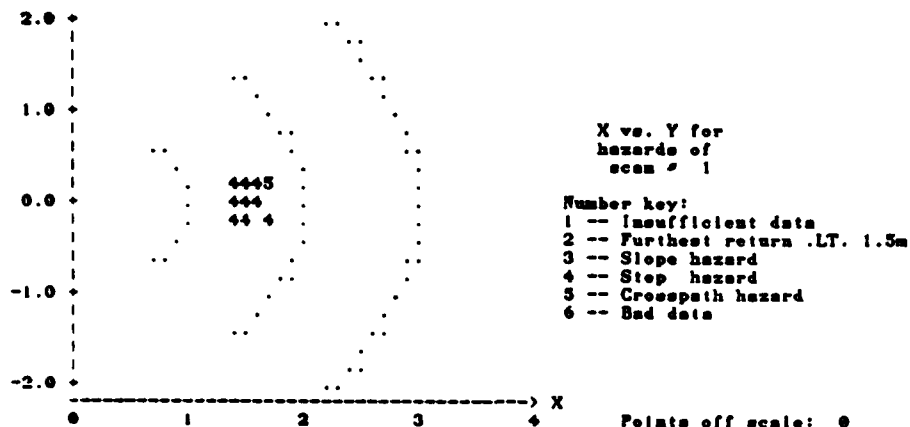


```
 2.0 +                          ..
     |
     |                  ..           ..
     |
 1.0 +                 .               .
     |          .              ..        .
     |        .          ..                .
     |                                            X vs. Y for
 0.0 +       .          44   4              .      hazards of
     |                  44   4                     scan #  1
     |        .          4  4.               .
     |          .              ..         .        Number key:
     |                 .                .          1 -- Insufficient data
-1.0 +                   ..            .           2 -- Furthest return .LT. 1.5m
     |                  ..         ..              3 -- Slope hazard
     |                      ..                     4 -- Step  hazard
-2.0 +                     ..                      5 -- Crosspath hazard
     +------------------------------------> X      6 -- Bad data
     0       1       2       3       4   X
     0       1       2       3       4             Points off scale:  0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	1.61	1.61	-0.12	-0.38	Step hazard
		1.88	1.87	-0.14	-0.02	Step hazard
16	-1.41	1.61	1.61	-0.04	-0.38	Step hazard
		1.61	1.61	-0.04	-0.38	Step hazard
		1.68	1.68	-0.04	-0.35	Step hazard
		1.71	1.71	-0.04	-0.31	Step hazard
		1.96	1.96	-0.05	0.00	Step hazard
17	1.40	1.56	1.56	0.04	-0.32	Step hazard
		1.71	1.71	0.04	-0.29	Step hazard
		1.96	1.96	0.05	0.00	Step hazard
18	4.21	1.61	1.61	0.12	-0.38	Step hazard
		1.61	1.61	0.12	-0.38	Step hazard
		1.68	1.67	0.12	-0.35	Step hazard
		1.71	1.71	0.13	-0.31	Step hazard
		1.96	1.95	0.14	0.00	Step hazard
19	7.02	1.61	1.60	0.20	-0.38	Step hazard
20	9.83	N O	H A Z A R D S	C A T A L O G E D		
21	12.64	N O	H A Z A R D S	C A T A L O G E D		
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.RANGE.15
File Creation Date : WED. AUG 10 1983   System time   19:49:15

**   ** MODEL1 PARAMETERS   **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT   =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

```
2.0 +
    |                      ..
    |                     ..
    |                  .
    |           ..          ..
1.0 +
    |              .              X vs. Y for
    |        ..      .            hazards of
    |     ..        .      ..       scan #  1
    |                4 54
0.0 +              444 4          Number key:
    |              44  .          1 -- Insufficient data
    |        .        .      ..   2 -- Furthest return .LT. 1.5m
    |                 .           3 -- Slope hazard
    |      ..        .      ..    4 -- Step  hazard
    |             .               5 -- Crosspath hazard
-1.0 +              .              6 -- Bad data
    |          .          .
    |        ..          ..
    |                 .
    |              .
-2.0 +              ..
    ------------------------------------> X
    0        1        2        3        4      Points off scale:  0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-25.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.34	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	1.64	1.64	-0.12	-0.36	Step hazard
		1.71	1.71	-0.13	-0.31	Step hazard
16	-1.41	1.61	1.61	-0.04	-0.39	Step hazard
		1.68	1.68	-0.04	-0.35	Step hazard
17	1.40	1.84	1.84	0.05	-0.11	Step hazard
		2.04	2.03	0.05	-0.01	Step hazard
18	4.21	1.84	1.83	0.13	-0.11	Step hazard
		2.00	1.99	0.15	-0.00	Crosspath hazard
		2.06	2.06	0.15	0.02	Step hazard
19	7.02	N O	H A Z A R D S	C A T A L O G E D		
20	9.83	N O	H A Z A R D S	C A T A L O G E D		
21	12.64	N O	H A Z A R D S	C A T A L O G E D		
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

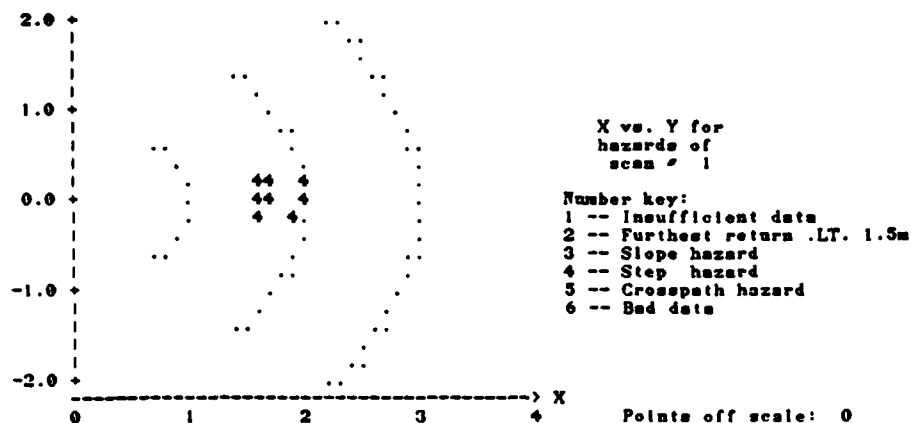Input file: MDL.RANGE.16
File Creation Date : WED, AUG 10 1983   System time   19:51:27

**   MODEL1 PARAMETERS   **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT   =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
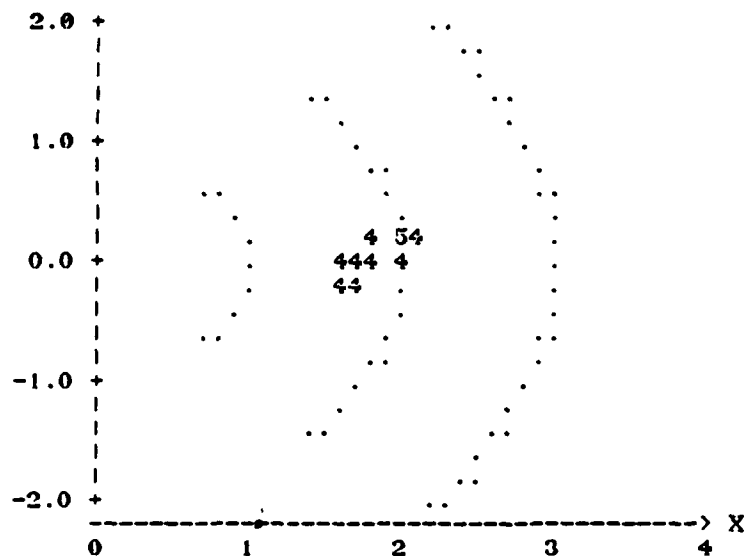SLOPE THRESHOLD =   30.00 DEGREES   .

```
2.0  +
     |                            . .
     |                              . .
     |                              .
     |                    . .          .
1.0  +
     |                     . .            .          X vs. Y for
     |               .                   . .         hazards of
     |             . .                       .          scan #  1
     |             .                                 
     |                    444  5                 .    Number key:
0.0  +                     4.4                        1 -- Insufficient data
     |             .                         .        2 -- Furthest return .LT. 1.5m
     |                     .                          3 -- Slope hazard
     |             . .                       .        4 -- Step  hazard
     |               .                   . .          5 -- Crosspath hazard
     |                   .                            6 -- Bad data
-1.0 +
     |                     .              .
     |                      .           .
     |               . .              .
     |                     . .
-2.0 +                            . .
     ---------------------.---------------------> X
      0      1      2       3      4            Points off scale:  0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	N O	H A Z A R D S	C A T A L O G E D		
16	-1.41	1.86	1.85	-0.05	-0.37	Step hazard
		2.13	2.13	-0.05	0.02	Step hazard
17	1.40	1.86	1.85	0.05	-0.37	Step hazard
		2.13	2.13	0.05	0.02	Step hazard
18	4.21	1.86	1.85	0.14	-0.39	Step hazard
19	7.02	1.86	1.84	0.23	-0.39	Step hazard
		2.00	1.98	0.24	-0.05	Crosspath hazard
		2.04	2.02	0.25	-0.02	Step hazard
		2.25	2.23	0.28	-0.02	Crosspath hazard
20	9.83	N O	H A Z A R D S	C A T A L O G E D		
21	12.64	N O	H A Z A R D S	C A T A L O G E D		
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.RANGE.17
File Creation Date : WED, AUG 10 1983   System time   19:53:52

** MODEL1 PARAMETERS **

HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

```
2.0 +
    I                              . .
    I                                 . .
    I
    I                            . .
1.0 +
    I                        . .              .
    I                                            . .
    I                  . .                            . .
    I              .                         . .
    I           .                  4                      .
0.0 +           .                  44                      .
    I              .                          . .
    I                 .                            . .
    I                      . .              .
    I              . .                            . .
-1.0 +
    I                        . .              .
    I
    I                     . .              . .
    I
    I                              . .
-2.0 +
    ------------.-------------------------------> X
    0          1          2          3          4
```

X vs. Y for
hazards of
  scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

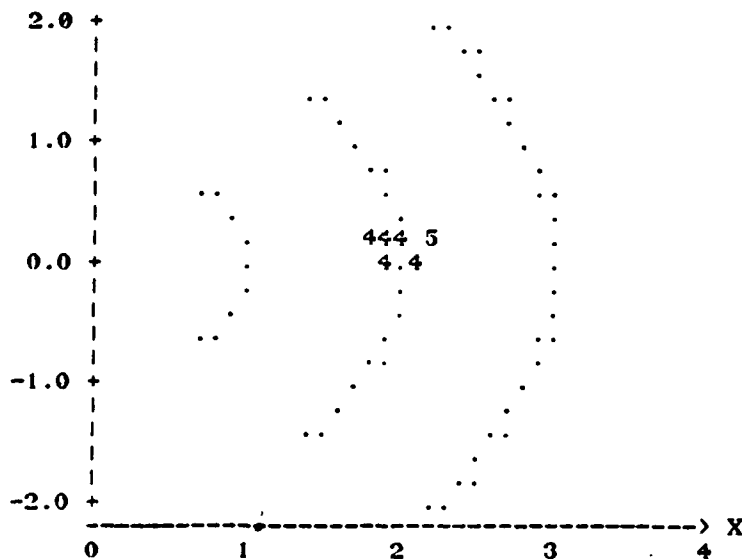| AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T	A L O G E D	
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	N O	H A Z A R D S	C A T A L O G E D		
16	-1.41	1.97	1.97	-0.05	-0.20	Step hazard
		2.04	2.03	-0.05	-0.06	Step hazard
17	1.40	1.86	1.85	0.05	-0.39	Step hazard
		1.97	1.97	0.05	-0.20	Step hazard
18	4.21	1.97	1.96	0.14	-0.20	Step hazard
		2.04	2.03	0.15	-0.06	Step hazard
19	7.02	N O	H A Z A R D S	C A T A L O G E D		
20	9.83	N O	H A Z A R D S	C A T A L O G E D		
21	12.64	N O	H A Z A R D S	C A T A L O G E D		
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.RANGE.18
File Creation Date : WED, AUG 10 1983   System time   19:55:41

**   MODEL1 PARAMETERS   **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT   =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

```
2.0 +
    I                              . .
    I                               . .
    I                        . .          . .
    I                          .         .
1.0 +                        .            .
    I                     . .               . .            X vs. Y for
    I               . .                         . .        hazards of
    I            .                                 .          scan #  1
    I                        4.4    5             .
0.0 +         .                 .4               .        Number key:
    I          .                                .        1 -- Insufficient data
    I               .                         .          2 -- Furthest return .LT. 1.5m
    I            . .                         . .          3 -- Slope hazard
    I                  . .                 .              4 -- Step  hazard
-1.0 +                   . .              .              5 -- Crosspath hazard
    I                 .                  .               6 -- Bad data
    I                       . .        .
    I                 . .             .
    I               .                . .
-2.0 +            .               . .
    ------------------------------------------> X
    0         1         2         3         4          Points off scale:  0
```

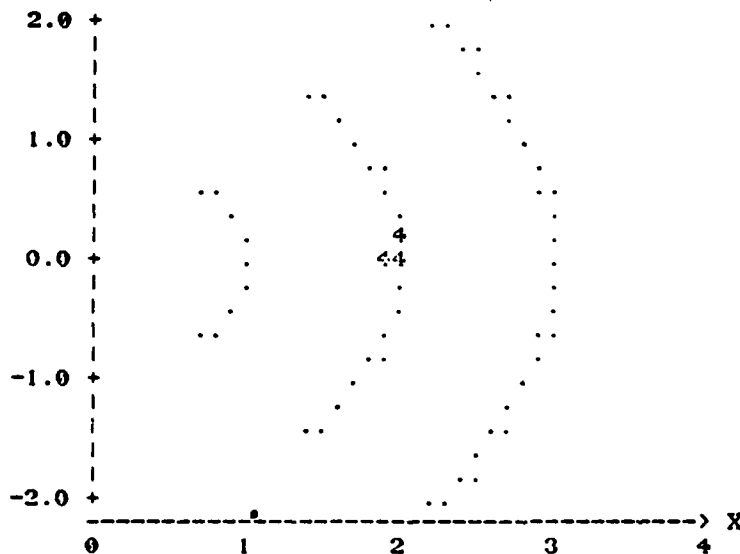| AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O H A Z A R D S C A T A L O G E D				
2	-40.74	N O H A Z A R D S C A T A L O G E D				
3	-37.93	N O H A Z A R D S C A T A L O G E D				
4	-35.12	N O H A Z A R D S C A T A L O G E D				
5	-32.31	N O H A Z A R D S C A T A L O G E D				
6	-29.50	N O H A Z A R D S C A T A L O G E D				
7	-26.69	N O H A Z A R D S C A T A L O G E D				
8	-23.83	N O H A Z A R D S C A T A L O G E D				
9	-21.08	N O H A Z A R D S C A T A L O G E D				
10	-18.26	N O H A Z A R D S C A T A L O G E D				
11	-15.45	N O H A Z A R D S C A T A L O G E D				
12	-12.64	N O H A Z A R D S C A T A L O G E D				
13	-9.84	N O H A Z A R D S C A T A L O G E D				
14	-7.02	N O H A Z A R D S C A T A L O G E D				
15	-4.22	N O H A Z A R D S C A T A L O G E D				
16	-1.41	2.09	2.09	-0.05	-0.35	Step hazard
17	1.40	2.09	2.09	0.05	-0.35	Step hazard
18	4.21	1.86	1.85	0.14	-0.39	Step hazard
		2.12	2.12	0.16	-0.27	Step hazard
		2.50	2.49	0.18	0.02	Crosspath hazard
19	7.02	N O H A Z A R D S C A T A L O G E D				
20	9.83	N O H A Z A R D S C A T A L O G E D				
21	12.64	N O H A Z A R D S C A T A L O G E D				
22	15.45	N O H A Z A R D S C A T A L O G E D				
23	18.26	N O H A Z A R D S C A T A L O G E D				
24	21.07	N O H A Z A R D S C A T A L O G E D				
25	23.88	N O H A Z A R D S C A T A L O G E D				
26	26.69	N O H A Z A R D S C A T A L O G E D				
27	29.50	N O H A Z A R D S C A T A L O G E D				
28	32.31	N O H A Z A R D S C A T A L O G E D				
29	35.12	N O H A Z A R D S C A T A L O G E D				
30	37.93	N O H A Z A R D S C A T A L O G E D				
31	40.74	N O H A Z A R D S C A T A L O G E D				
32	43.55	N O H A Z A R D S C A T A L O G E D				

Input file: MDL.RANGE.19
File Creation Date : WED, AUG 10 1983   System time   20:04:50
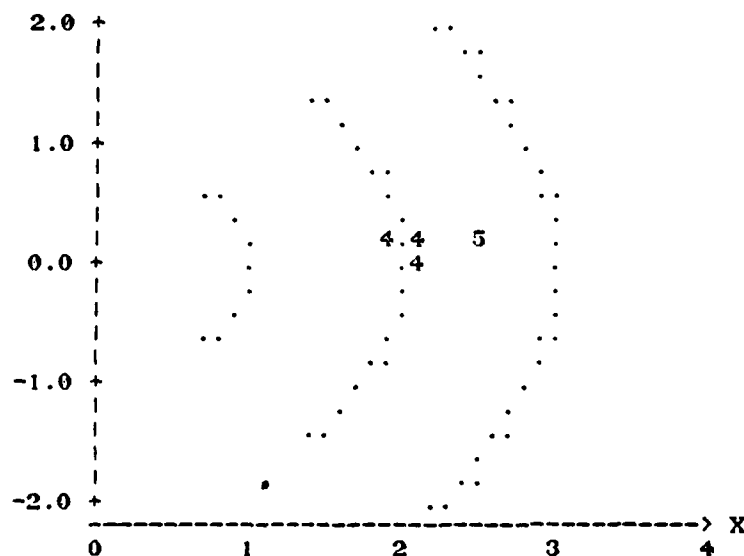
**   MODEL1 PARAMETERS   **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

```
2.0 +                         . .
    |                          . .
    |                           .
    |                   . .              .         .
    |                    .
1.0 +
    |                        . .              .        X vs. Y for
    |                     .           .        . .     hazards of
    |              . .              .          .         scan #  1
    |               .             .      5    .
0.0 +                 .          .44          .         Number key:
    |                  .            .          .        1 -- Insufficient data
    |                   .           .           .       2 -- Furthest return .LT. 1.5m
    |                                .          . .      3 -- Slope hazard
    |              . .             .                     4 -- Step  hazard
    |                             . .          . .       5 -- Crosspath hazard
-1.0 +                 .             .                    6 -- Bad data
    |                    . .            .
    |                      .             .
    |                       . .         .
    |
-2.0 +          •           . .
    |
    ------------------------------------------------> X
    0          1          2          3          4      Points off scale:  0
```

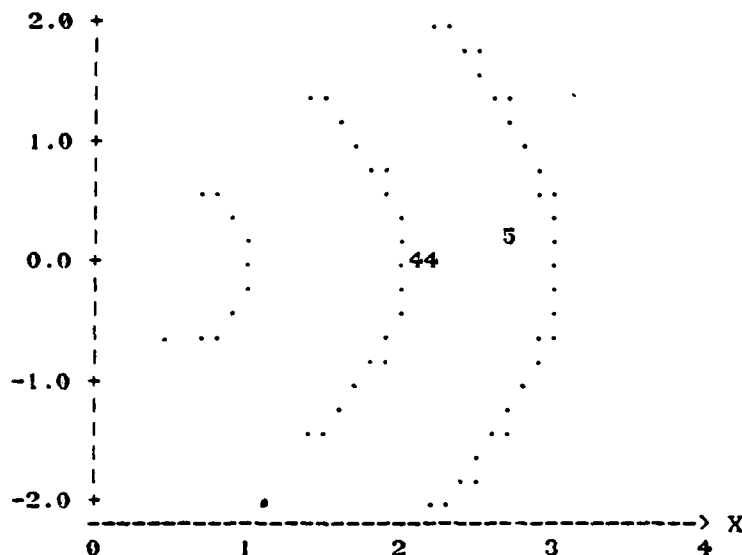| AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S		C A T A L O G E D	
2	-40.74	N O	H A Z A R D S		C A T A L O G E D	
3	-37.93	N O	H A Z A R D S		C A T A L O G E D	
4	-35.13	N O	H A Z A R D S		C A T A L O G E D	
5	-32.31	N O	H A Z A R D S		C A T A L O G E D	
6	-29.50	N O	H A Z A R D S		C A T A L O G E D	
7	-26.69	N O	H A Z A R D S		C A T A L O G E D	
8	-23.83	N O	H A Z A R D S		C A T A L O G E D	
9	-21.08	N O	H A Z A R D S		C A T A L O G E D	
10	-18.26	N O	H A Z A R D S		C A T A L O G E D	
11	-15.45	N O	H A Z A R D S		C A T A L O G E D	
12	-12.64	N O	H A Z A R D S		C A T A L O G E D	
13	-9.84	N O	H A Z A R D S		C A T A L O G E D	
14	-7.02	N O	H A Z A R D S		C A T A L O G E D	
15	-4.22	N O	H A Z A R D S		C A T A L O G E D	
16	-1.41	2.09	2.09	-0.05	-0.37	Step hazard
		2.09	2.09	-0.05	-0.37	Step hazard
		2.20	2.20	-0.05	-0.08	Step hazard
17	1.40	2.09	2.09	0.05	-0.37	Step hazard
		2.14	2.13	0.05	-0.36	Step hazard
18	4.21	2.75	2.74	0.20	-0.07	Crosspath hazard
19	7.02	N O	H A Z A R D S		C A T A L O G E D	
20	9.83	N O	H A Z A R D S		C A T A L O G E D	
21	12.64	N O	H A Z A R D S		C A T A L O G E D	
22	15.45	N O	H A Z A R D S		C A T A L O G E D	
23	18.26	N O	H A Z A R D S		C A T A L O G E D	
24	21.07	N O	H A Z A R D S		C A T A L O G E D	
25	23.88	N O	H A Z A R D S		C A T A L O G E D	
26	26.69	N O	H A Z A R D S		C A T A L O G E D	
27	29.50	N O	H A Z A R D S		C A T A L O G E D	
28	32.31	N O	H A Z A R D S		C A T A L O G E D	
29	35.12	N O	H A Z A R D S		C A T A L O G E D	
30	37.93	N O	H A Z A R D S		C A T A L O G E D	
31	40.74	N O	H A Z A R D S		C A T A L O G E D	
32	43.55	N O	H A Z A R D S		C A T A L O G E D	

Input file: MDL.RANGE.20
File Creation Date : WED, AUG 10 1983   System time   20:09:37

```
               **   MODEL1 PARAMETERS   **
         HEIGHT FILTER COEFFICIENT =          0.25
         SLOPE FILTER COEFFICIENT  =          0.90
         LEVEL GROUND STEP THRESHOLD =        0.25 METERS
         SLOPE THRESHOLD =                    30.00 DEGREES
```

X vs. Y for
hazards of
  scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	N O	H A Z A R D S	C A T A L O G E D		
16	-1.41	2.29	2.29	-0.06	-0.32	Step hazard
17	1.40	2.29	2.29	0.06	-0.31	Step hazard
18	4.21	2.29	2.29	0.17	-0.32	Step hazard
		2.50	2.49	0.13	-0.05	Crosspath hazard
		2.75	2.74	0.20	-0.05	Crosspath hazard
19	7.02	N O	H A Z A R D S	C A T A L O G E D		
20	9.83	N O	H A Z A R D S	C A T A L O G E D		
21	12.64	N O	H A Z A R D S	C A T A L O G E D		
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.RANGE.21
File Creation Date : WED, AUG 10 1983   System time   20:12:51

** MODEL1 PARAMETERS **

HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT   =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

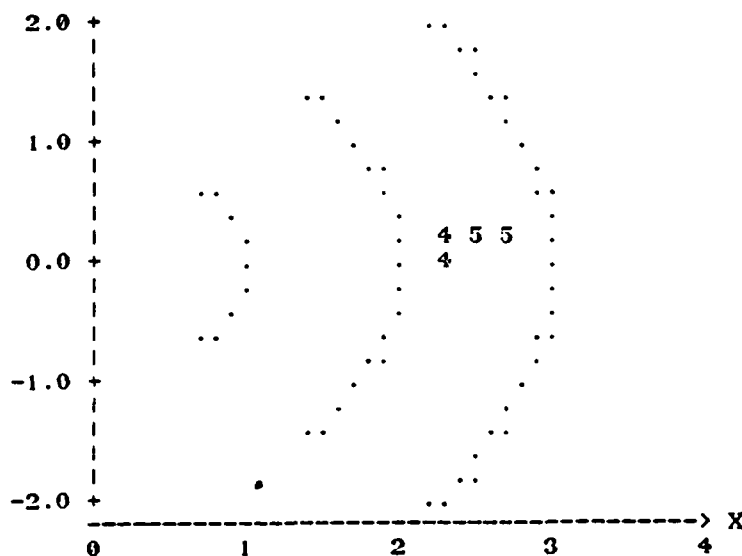| AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T	A L O G E D	
2	-40.74	N O	H A Z A R D S	C A T	A L O G E D	
3	-37.93	H A Z A R D S	C A T	A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T	A L O G E D	
5	-32.31	N O	H A Z A R D S	C A T	A L O G E D	
6	-29.50	N O	H A Z A R D S	C A T	A L O G E D	
7	-26.69	N O	H A Z A R D S	C A T	A L O G E D	
8	-23.88	N O	H A Z A R D S	C A T	A L O G E D	
9	-21.08	N O	H A Z A R D S	C A T	A L O G E D	
10	-18.26	N O	H A Z A R D S	C A T	A L O G E D	
11	-15.45	N O	H A Z A R D S	C A T	A L O G E D	
12	-12.64	N O	H A Z A R D S	C A T	A L O G E D	
13	-9.84	N O	H A Z A R D S	C A T	A L O G E D	
14	-7.02	N O	H A Z A R D S	C A T	A L O G E D	
15	-4.22	N O	H A Z A R D S	C A T	A L O G E D	
16	-1.41	2.29	2.29	-0.06	-0.34	Step hazard
17	1.40	2.29	2.29	0.06	-0.34	Step hazard
18	4.21	2.29	2.29	0.17	-0.36	Step hazard
		2.50	2.49	0.18	-0.16	Crosspath hazard
		2.75	2.74	0.20	-0.07	Crosspath hazard
19	7.02	N O	H A Z A R D S	C A T	A L O G E D	
20	9.83	N O	H A Z A R D S	C A T	A L O G E D	
21	12.64	N O	H A Z A R D S	C A T	A L O G E D	
22	15.45	N O	H A Z A R D S	C A T	A L O G E D	
23	18.26	N O	H A Z A R D S	C A T	A L O G E D	
24	21.07	N O	H A Z A R D S	C A T	A L O G E D	
25	23.88	N O	H A Z A R D S	C A T	A L O G E D	
26	26.69	N O	H A Z A R D S	C A T	A L O G E D	
27	29.50	N O	H A Z A R D S	C A T	A L O G E D	
28	32.31	N O	H A Z A R D S	C A T	A L O G E D	
29	35.12	N O	H A Z A R D S	C A T	A L O G E D	
30	37.93	N O	H A Z A R D S	C A T	A L O G E D	
31	40.74	N O	H A Z A R D S	C A T	A L O G E D	
32	43.55	N O	H A Z A R D S	C A T	A L O G E D	

Input file: MDL.RANGE.22
File Creation Date : WED, AUG 10 1983   System time   20:21:43

**   MODEL1 PARAMETERS   **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT   =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

```
2.0 +                                  . .
    |
    |                              . .
    |                      . .                . .
1.0 +                    .                   .
    |                                                      X vs. Y for
    |                  . .                 .               hazards of
    |              . .         .        . .                  scan #  1
    |            .                .    .
0.0 +            .               .  4   .                 Number key:
    |                          .       . .                1 -- Insufficient data
    |            .               .    .                   2 -- Furthest return .LT. 1.5m
    |              . .          .      . .                 3 -- Slope hazard
    |                . .         .                         4 -- Step  hazard
-1.0 +                .                .                   5 -- Crosspath hazard
    |                    . .           .                   6 -- Bad data
    |                      . .        . .
    |                          . .
-2.0 +            .              . .
    ------------------------------------------> X
    0         1         2         3         4            Points off scale:  0
```
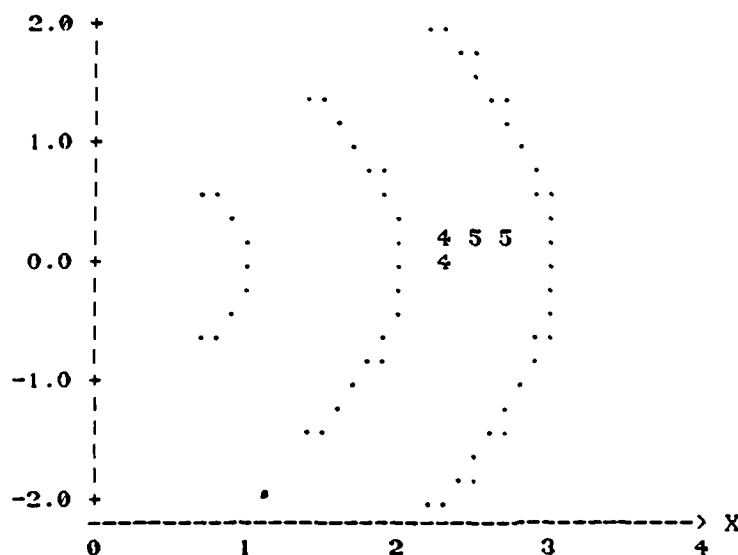
AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	N O	H A Z A R D S	C A T A L O G E D		
16	-1.41	N O	H A Z A R D S	C A T A L O G E D		
17	1.40	2.29	2.29	0.06	-0.36	Step hazard
18	4.21	N O	H A Z A R D S	C A T A L O G E D		
19	7.02	N O	H A Z A R D S	C A T A L O G E D		
20	9.83	N O	H A Z A R D S	C A T A L O G E D		
21	12.64	N O	H A Z A R D S	C A T A L O G E D		
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.RANGE.23
File Creation Date : WED, AUG 10 1983   System time   20:26:51

```
             **   MODEL1 PARAMETERS   **
        HEIGHT FILTER COEFFICIENT =        0.25
        SLOPE FILTER COEFFICIENT  =        0.90
        LEVEL GROUND STEP THRESHOLD =      0.25 METERS
        SLOPE THRESHOLD =                  30.00 DEGREES
```

```
 2.0 +                    ..
     |                        ..
     |                         .
     |            ..         ..
     |            .           .
 1.0 +                                   X vs. Y for
     |         ..         .              hazards of
     |      ..          .       ..        scan #  1
     |      .          .          .
     |                                   Number key:
 0.0 +      .          .          .      1 -- Insufficient data
     |      .          .          .      2 -- Furthest return .LT. 1.5m
     |      ..          .        .       3 -- Slope hazard
     |      .          .          .      4 -- Step  hazard
-1.0 +       .         .                 5 -- Crosspath hazard
     |         .          .              6 -- Bad data
     |         ..         ..
     |                   .
     |                  ..
-2.0 +                 ..
     -------------------------------------> X
     0       1        2        3        4        Points off scale:  0
```

NO HAZARDS CATALOGED THIS SCAN

7.2.6 Hole Tests Results

7.2.6.1 Small Square Hole: 30 cm x 30 cm

Input file: MDL.HOLE.00
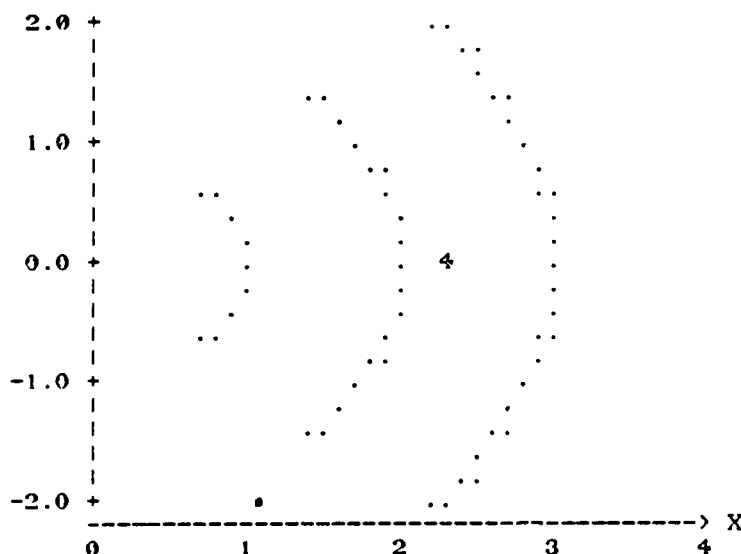File Creation Date : MON. AUG 08 1983   System time   19:34:47

        **   MODEL1 PARAMETERS   **
        HEIGHT FILTER COEFFICIENT :   0.25
        SLOPE FILTER COEFFICIENT :   0.90
        LEVEL GROUND STEP THRESHOLD :   0.25 METERS
        SLOPE THRESHOLD :   30.00 DEGREES

```
  2.0 +                      . .
      |
      |                 . . .        .
  1.0 +                                            X vs. Y for
      |            . .             . . .            hazards of
      |          .                     .             scan #  1
  0.0 +         .                       .
      |          .                     .          Number key:
      |            .                 .            1 -- Insufficient data
      |                             .             2 -- Furthest return .LT. 1.5m
 -1.0 +            . .             . .            3 -- Slope hazard
      |                                           4 -- Step  hazard
      |                 . . .   . .               5 -- Crosspath hazard
      |                                           6 -- Bad data
 -2.0 +                      . .
      -----------------------------------> X
      0         1         2         3         4       Points off scale:  0
```

            .

        NO HAZARDS CATALOGED THIS SCAN

Input file: MDL.LITTLE.HOLE.04
File Creation Date : MON. AUG 08 1983   System time   19:44:21

        **   MODEL1 PARAMETERS   **
        HEIGHT FILTER COEFFICIENT :   0.25
        SLOPE FILTER COEFFICIENT :   0.90
        LEVEL GROUND STEP THRESHOLD :   0.25 METERS
        SLOPE THRESHOLD :   30.00 DEGREES

```
  2.0 +                      . .
      |                 . .        .
      |              . .             . .
  1.0 +            .                     .         X vs. Y for
      |                                             hazards of
      |         . .                 . .              scan #  1
  0.0 +         .                       .
      |           .                 .            Number key:
      |                             .            1 -- Insufficient data
      |             .             .              2 -- Furthest return .LT. 1.5m
 -1.0 +                                          3 -- Slope hazard
      |                                          4 -- Step  hazard
      |              . .       . .               5 -- Crosspath hazard
      |                                          6 -- Bad data
 -2.0 +                      . .
      -----------------------------------> X
      0         1         2         3         4       Points off scale:  0
```

        NO HAZARDS CATALOGED THIS SCAN

Input file: MDL.LITTLE.HOLE.08
File Creation Date : MON, AUG 08 1983   System time   19:59:14

```
            **   MODEL1 PARAMETERS   **
        HEIGHT FILTER COEFFICIENT =        0.25
        SLOPE FILTER COEFFICIENT  =        0.90
        LEVEL GROUND STEP THRESHOLD =      0.25 METERS
        SLOPE THRESHOLD =                 30.00 DEGREES
```

```
2.0 +                      . .

                               . .
1.0 +              .              .           X vs. Y for
              .         .      .              hazards of
          .                      . .            scan #  1
0.0 +     .                      .
          .                      .            Number key:
          .                      .            1 -- Insufficient data
          .                      .            2 -- Furthest return .LT. 1.5m
          .                      .            3 -- Slope hazard
-1.0 +        .              .               4 -- Step  hazard
                                             5 -- Crosspath hazard
             . .         .                   6 -- Bad data
                    .  .
-2.0 +            . .
    +-------------------------------> X
    0       1       2       3       4        Points off scale:  0
```

NO HAZARDS CATALOGED THIS SCAN
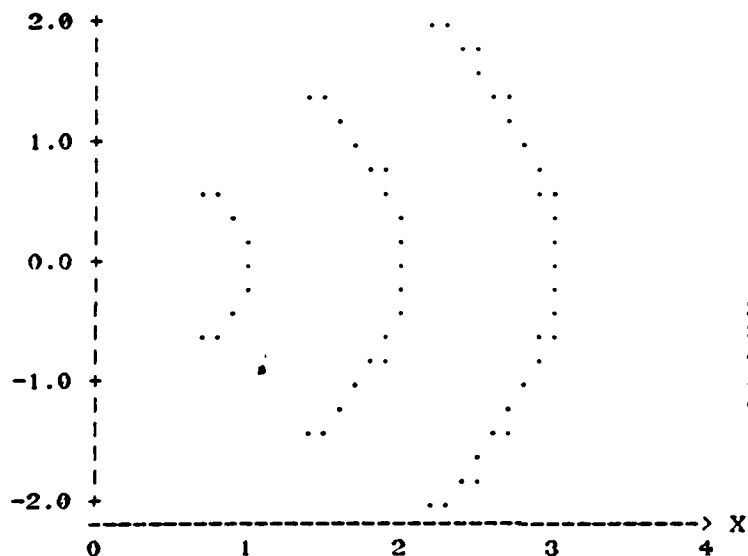

Input file: MDL.LITTLE.HOLE.10
File Creation Date : MON, AUG 08 1983   System time   20:08:20

```
            **   MODEL1 PARAMETERS   **
        HEIGHT FILTER COEFFICIENT =        0.25
        SLOPE FILTER COEFFICIENT  =        0.90
        LEVEL GROUND STEP THRESHOLD =      0.25 METERS
        SLOPE THRESHOLD =                 30.00 DEGREES
```

```
2.0 +                      . .
                               . .
                            . .
                               .
1.0 +                  .          .          X vs. Y for
                  .                          hazards of
              .                      .         scan #  1
0.0 +         .                      .
              .                      .        Number key:
              .                      .        1 -- Insufficient data
              .                      .        2 -- Furthest return .LT. 1.5m
              .                      .        3 -- Slope hazard
-1.0 +            .              .            4 -- Step  hazard
                                             5 -- Crosspath hazard
                  . .         .              6 -- Bad data
                        .  .
-2.0 +                . .
    +-------------------------------> X
    0       1       2       3       4        Points off scale:  0
```

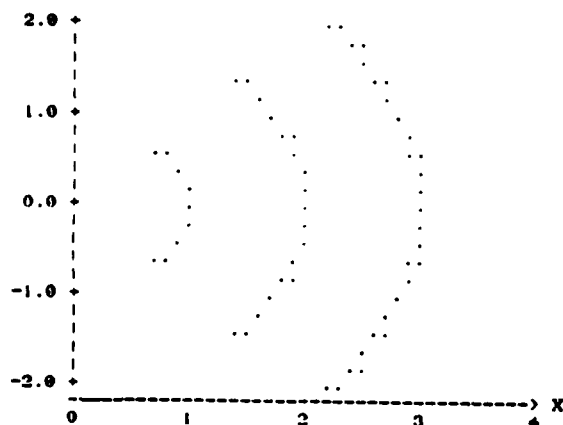NO HAZARDS CATALOGED THIS SCAN
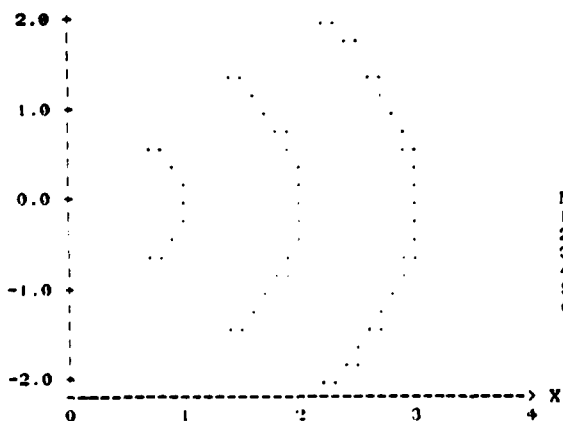
Input file: MDL.LITTLE.HOLE.12
File Creation Date : MON. AUG 08 1983   System time   20:15:21

**   MODEL1 PARAMETERS   **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT   =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES


```
 2.0 +
     I                              . .
     I                            .
     I                       . .
     I                     .
 1.0 +                    .           .         X vs. Y for
     I                  . .           .         hazards of
     I          . .       4       .      . .       scan #  1
     I        .         .         .
 0.0 +       .        :          .             Number key:
     I       .        :          .             1 -- Insufficient data
     I        .                .               2 -- Furthest return .LT. 1.5m
     I       . .              .                3 -- Slope hazard
     I                      . .                4 -- Step  hazard
-1.0 +        .             .                  5 -- Crosspath hazard
     I         .           .                   6 -- Bad data
     I          . .      .
     I                 . .
     I              . .
-2.0 +       .        . .
     -------------------------------------------> X
     0       1        2        3        4       Points off scale:  0
```
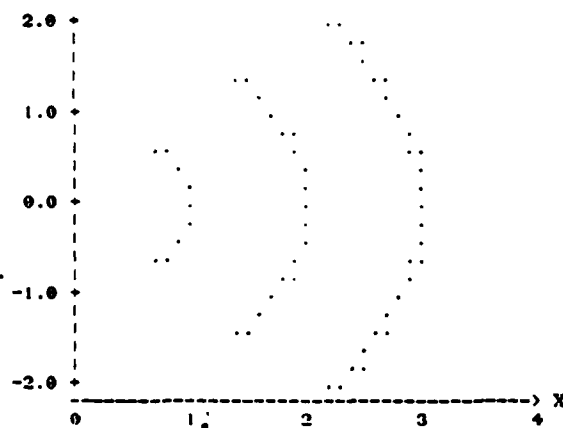
AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	N O	H A Z A R D S	C A T A L O G E D		
16	-1.41	N O	H A Z A R D S	C A T A L O G E D		
17	1.40	N O	H A Z A R D S	C A T A L O G E D		
18	4.21	N O	H A Z A R D S	C A T A L O G E D		
19	7.02	N O	H A Z A R D S	C A T A L O G E D		
20	9.83	N O	H A Z A R D S	C A T A L O G E D		
21	12.64	N O	H A Z A R D S	C A T A L O G E D		
22	15.45	1.45	1.39	0.39	-0.28	Step hazard
		1.45	1.39	0.39	-0.28	Step hazard
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.LITTLE.HOLE.14
File Creation Date : MON, AUG 08 1983   System time   20:25:22

** MODEL1 PARAMETERS **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES
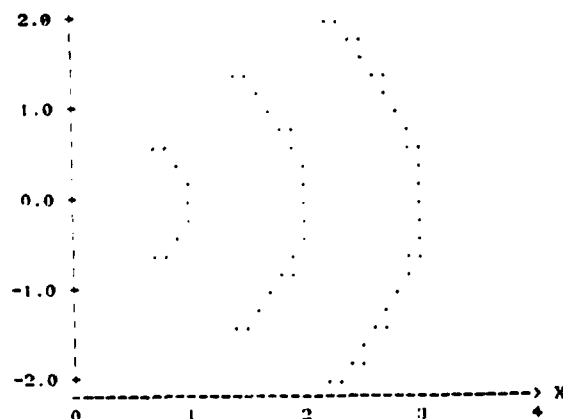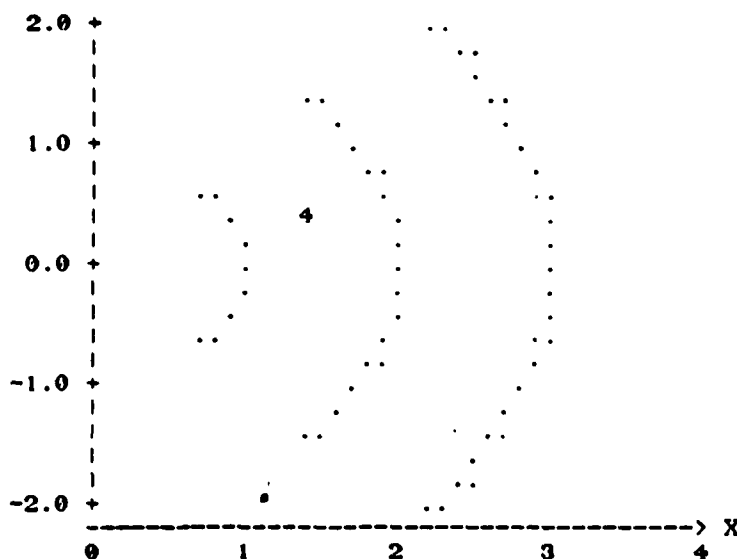
```
2.0 +                            . .
    |                               . .
    |                            . .
1.0 +              .                    .           X vs. Y for
    |          . .          . .                     hazards of
    |    . .          4       .           .            scan = 1
    |        4 4      4               .
0.0 +        . 4      4         .            .      Number key:
    |                              . .               1 -- Insufficient data
    |          . .                 .                 2 -- Furthest return .LT. 1.5m
    |                            .                    3 -- Slope hazard
-1.0 +              . .                .              4 -- Step  hazard
    |                              . .                5 -- Crosspath hazard
    |          . .               .                    6 -- Bad data
    |                         . .
-2.0 +                       . .
    +------------------------------> X
    0       1       2       3       4          Points off scale:  0
        .
        s
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	N O	H A Z A R D S	C A T A L O G E D		
16	-1.41	N O	H A Z A R D S	C A T A L O G E D		
17	1.40	1.06	1.06	0.03	0.01	Step hazard
		1.41	1.41	0.03	-0.25	Step hazard
18	4.21	1.06	1.05	0.08	0.01	Step hazard
		1.41	1.40	0.10	-0.25	Step hazard
		1.41	1.40	0.10	-0.25	Step hazard
		1.41	1.40	0.10	-0.25	Step hazard
19	7.02	1.06	1.05	0.13	0.01	Step hazard
		1.41	1.40	0.17	-0.25	Step hazard
		1.41	1.40	0.17	-0.25	Step hazard
20	9.83	1.06	1.04	0.18	0.01	Step hazard
		1.41	1.39	0.24	-0.25	Step hazard
21	12.64	1.06	1.03	0.23	0.01	Step hazard
		1.41	1.37	0.31	-0.25	Step hazard
22	15.45	1.10	1.06	0.29	0.00	Step hazard
		1.41	1.36	0.37	-0.25	Step hazard
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

7.2.6.2 <u>Rectangular</u> <u>Hole</u>: <u>30</u> <u>cm</u> x <u>60</u> <u>cm</u>

Input file: MDL.HOLE.00
File Creation Date : MON, AUG 08 1983   System time   19:34:47

**   MODEL: PARAMETERS   **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT   =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES
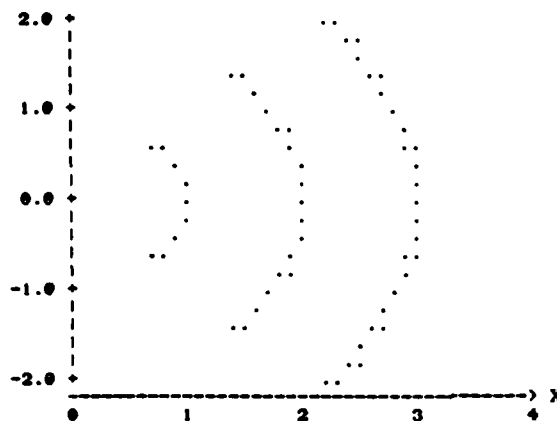
X vs. Y for
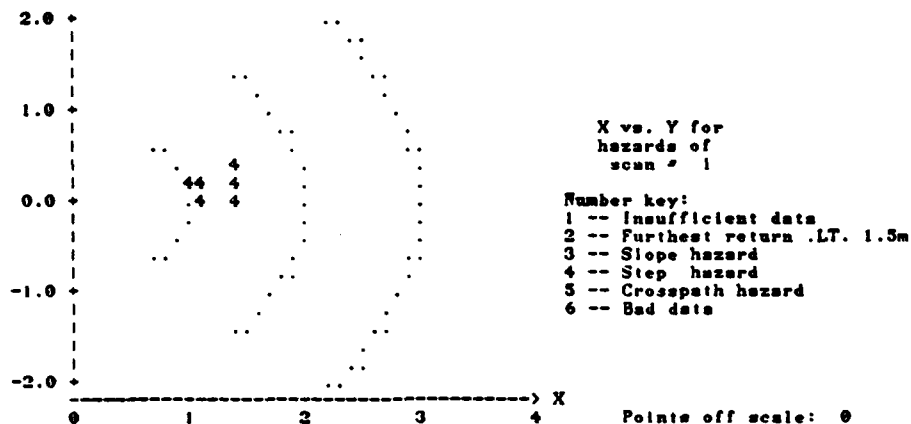hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

NO HAZARDS CATALOGED THIS SCAN

Input file: MDL.MIDDLE.HOLE.04
File Creation Date : MON, AUG 08 1983   System time   22:15:26

**   MODEL: PARAMETERS   **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT   =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

NO HAZARDS CATALOGED THIS SCAN

220

Input file: MDL.MIDDLE.HOLE.08
File Creation Date : MON, AUG 08 1983   System time   21:43:33

```
                    **   MODEL1 PARAMETERS   **
          HEIGHT FILTER COEFFICIENT =           0.25
          SLOPE FILTER COEFFICIENT  =           0.90
          LEVEL GROUND STEP THRESHOLD =         0.25 METERS
          SLOPE THRESHOLD =                    30.00 DEGREES
```



```
  2.0 +                           ..
      |                             ..
      |              ..            ..
      |                .            .
  1.0 +                  .            .          X vs. Y for
      |                   .             .        hazards of
      |          ..        .             ..         scan #  1
      |            .        .             .
  0.0 +            .        .             .      Number key:
      |            .        .             .      1 -- Insufficient data
      |            .        .             .      2 -- Furthest return .LT. 1.5m
      |          ..        .             ..      3 -- Slope hazard
      |            ..        .           ..      4 -- Step  hazard
 -1.0 +        .           .           .         5 -- Crosspath hazard
      |            ..        .           ..      6 -- Bad data
      |              ..        .        ..
      |                         .
 -2.0 +                      ..
      ---------------------------------------> X
      0       1        2        3        4       Points off scale:  0
```

NO HAZARDS CATALOGED THIS SCAN

Input file: MDL.MIDDLE.HOLE.10
File Creation Date : MON, AUG 08 1983   System time   21:52:50

```
                        **   MODEL1 PARAMETERS   **
               HEIGHT FILTER COEFFICIENT =          0.25
               SLOPE FILTER COEFFICIENT  =          0.90
               LEVEL GROUND STEP THRESHOLD =        0.25 METERS
               SLOPE THRESHOLD =                    30.00 DEGREES
```

```
2.0 +
    i                          . .
    i                               .
    i                  . .            .
    i                                  . .
1.0 +                       .           .
    i                   . .               .
    i         . .                          .
    i                   44      .           .
    i                           .           .
0.0 +                           .           .
    i                           .           .
    i         . .               .           .
    i                           .           .
    i         . .               .         . .
-1.0 +                          .           .
    i                                     . .
    i                 . .               . .
    i                        .         . .
    i              .                  . .
-2.0 +                          . .
    -------------------------------------> X
    0         1         2         3         4
```

X vs. Y for
hazards of
 scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
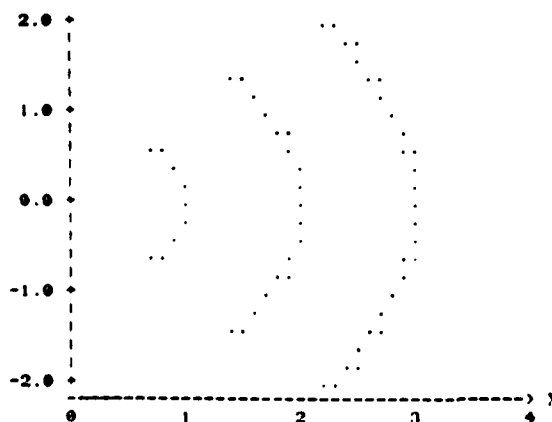4 -- Step hazard
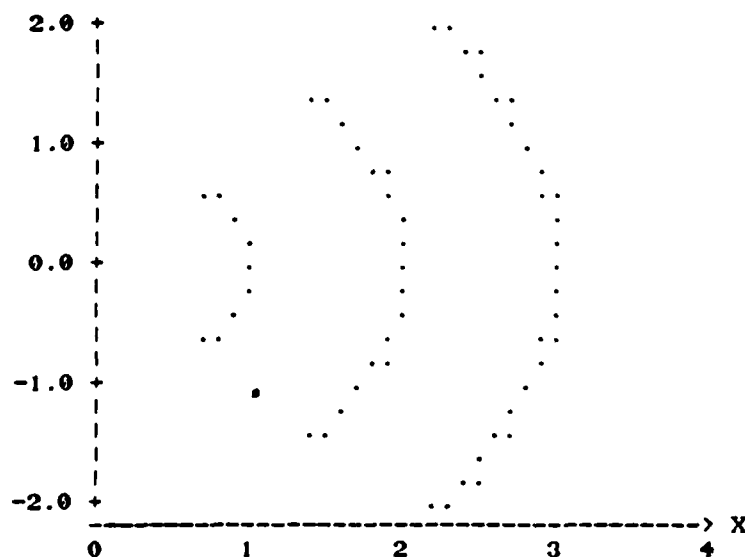5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	N O	H A Z A R D S	C A T A L O G E D		
16	-1.41	N O	H A Z A R D S	C A T A L O G E D		
17	1.40	N O	H A Z A R D S	C A T A L O G E D		
18	4.21	N O	H A Z A R D S	C A T A L O G E D		
19	7.02	N O	H A Z A R D S	C A T A L O G E D		
20	9.83	N O	H A Z A R D S	C A T A L O G E D		
21	12.64	1.55	1.51	0.34	-0.22	Step hazard
22	15.45	1.48	1.43	0.39	-0.26	Step hazard
		1.48	1.43	0.39	-0.26	Step hazard
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.MIDDLE.HOLE.12
File Creation Date : MON, AUG 08 1983   System time   21:22:45
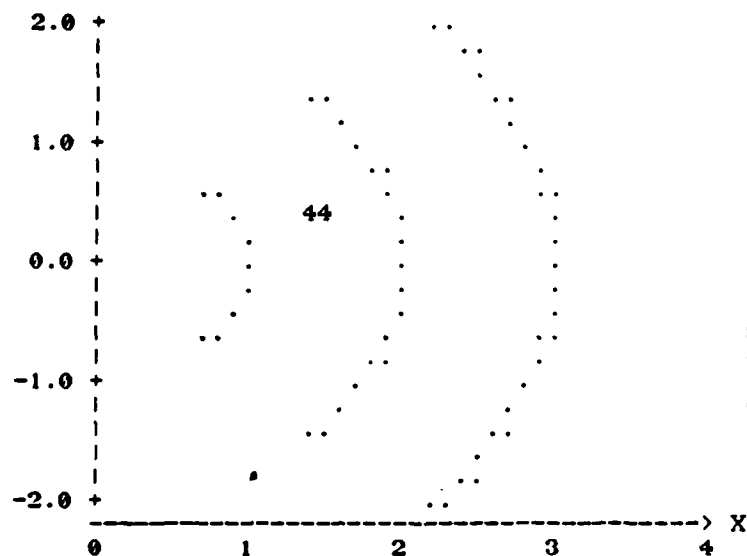
** MODEL1 PARAMETERS **

HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

```
2.0 +
    I                        . .
    I                       . .
    I                   . .         . .
1.0 +
    I                  .          .       X vs. Y for
    I               . .            .      hazards of
    I         . .         44 4        .     scan #  1
    I        .          444         .
0.0 +       .            5        .       Number key:
    I                  .        .         1 -- Insufficient data
    I         .                 .        2 -- Furthest return .LT. 1.5m
    I        . .              . .        3 -- Slope hazard
    I                                    4 -- Step  hazard
-1.0 +             .          .          5 -- Crosspath hazard
    I                                    6 -- Bad data
    I         . .           . .
    I                      .
    I                    . .
-2.0 +                  . .
    +-------------------------------------> X
    0        1        2        3        4      Points off scale:  0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	H A Z A R D S	C A T A L O G E D		
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	N O	H A Z A R D S	C A T A L O G E D		
16	-1.41	1.50	1.50	-0.04	0.05	Crosspath hazard
17	1.40	N O	H A Z A R D S	C A T A L O G E D		
18	4.21	N O	H A Z A R D S	C A T A L O G E D		
19	7.02	1.56	1.55	0.19	-0.32	Step hazard
		1.71	1.70	0.21	-0.29	Step hazard
20	9.83	1.56	1.54	0.27	-0.32	Step hazard
		1.71	1.68	0.29	-0.30	Step hazard
		1.71	1.68	0.29	-0.30	Step hazard
21	12.64	1.59	1.55	0.35	-0.27	Step hazard
		1.71	1.67	0.37	-0.29	Step hazard
22	15.45	1.45	1.39	0.39	-0.28	Step hazard
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.MIDDLE.HOLE.14
File Creation Date : MON, AUG 08 1983   System time   21:04:27

```
            **  MODEL1 PARAMETERS  **
    HEIGHT FILTER COEFFICIENT =        0.25
    SLOPE FILTER COEFFICIENT  =        0.90
    LEVEL GROUND STEP THRESHOLD =      0.25 METERS
    SLOPE THRESHOLD =                  30.00 DEGREES
```
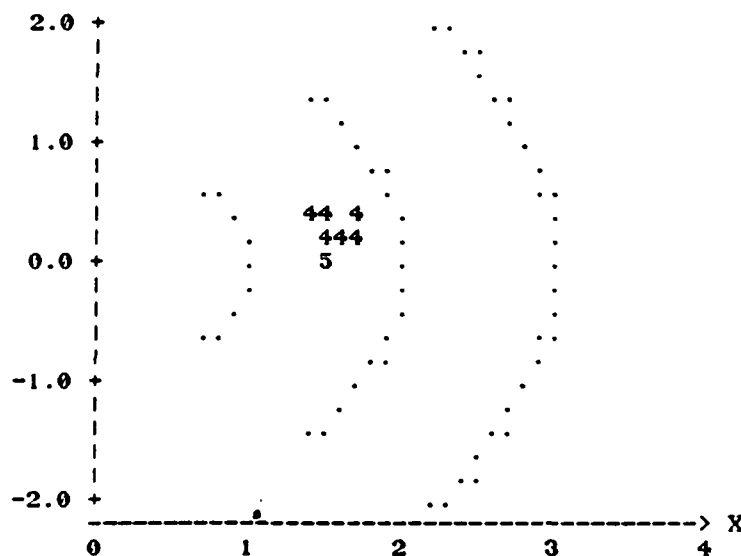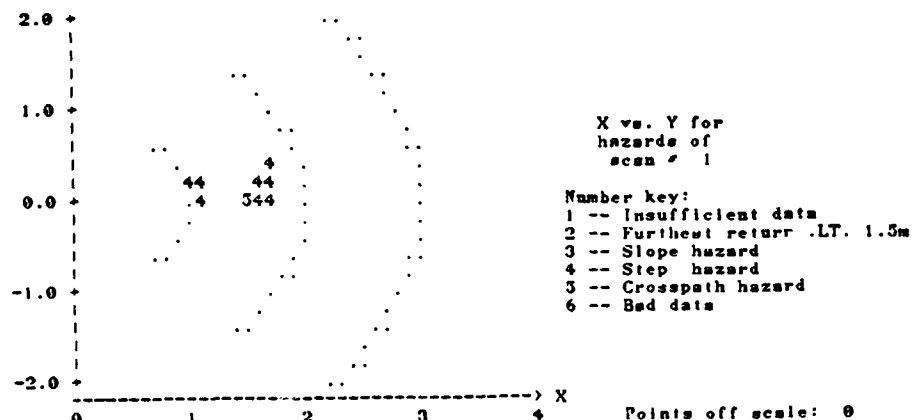

X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.36	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	N O	П A Z A R D S	C A T A L O G E D		
13	-9.84	N O	Н A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	N O	H A Z A R D S	C A T A L O G E D		
16	-1.41	1.50	1.50	-0.04	0.05	Crosspath hazard
		1.75	1.75	-0.04	0.01	Crosspath hazard
17	1.40	1.06	1.06	0.03	0.01	Step hazard
		1.61	1.61	0.04	-0.38	Step hazard
		1.61	1.61	0.04	-0.38	Step hazard
		1.68	1.68	0.04	-0.35	Step hazard
		1.71	1.71	0.04	-0.31	Step hazard
18	4.21	1.06	1.05	0.08	0.01	Step hazard
		1.61	1.61	0.12	-0.38	Step hazard
		1.61	1.61	0.12	-0.38	Step hazard
		1.68	1.67	0.12	-0.35	Step hazard
		1.71	1.71	0.13	-0.31	Step hazard
19	7.02	1.06	1.05	0.13	0.01	Step hazard
		1.61	1.60	0.20	-0.38	Step hazard
		1.61	1.60	0.20	-0.38	Step hazard
		1.68	1.67	0.21	-0.35	Step hazard
20	9.83	1.06	1.04	0.18	0.01	Step hazard
		1.61	1.59	0.28	-0.38	Step hazard
		1.61	1.59	0.28	-0.38	Step hazard
		1.71	1.68	0.29	-0.32	Step hazard
21	12.64	1.06	1.03	0.23	0.01	Step hazard
		1.77	1.72	0.39	-0.33	Step hazard
22	15.45	1.10	1.06	0.29	0.00	Step hazard
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

7.2.6.3 Large Square Hole: 60 cm x 60 cm

Input file: MDL.HOLE.00
File Creation Date : MON. AUG 08 1983   System time   19:34:47

```
                ** MODEL1 PARAMETERS  **
        HEIGHT FILTER COEFFICIENT =        0.25
        SLOPE FILTER COEFFICIENT  =        0.90
        LEVEL GROUND STEP THRESHOLD =      0.25 METERS
        SLOPE THRESHOLD =                 30.00 DEGREES
```
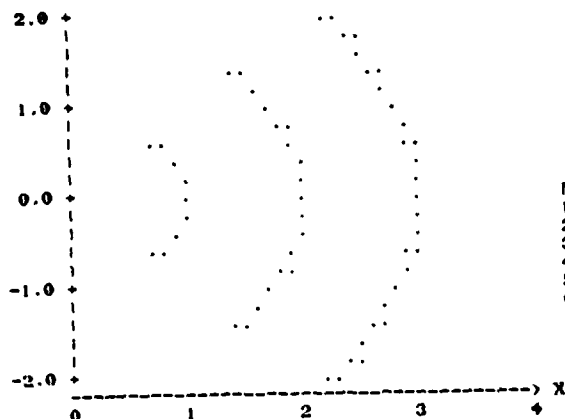
```
2.0 +                       ..
    |                     .       .
    |
    |                 .             .
1.0 +              .                 .          X vs. Y for
    |            .                     .         hazards of
    |           .                       .         scan #  1
0.0 +          .                         .       Number key:
    |           .                       .        1 -- Insufficient data
    |            .                     .         2 -- Furthest return .LT. 1.5m
    |             .                                 3 -- Slope hazard
-1.0 +              .                 .          4 -- Step  hazard
    |                 .             .             5 -- Crosspath hazard
    |                                             6 -- Bad data
    |                     .       .
-2.0 +                       ...
    -----------------------------------> X
     0       1       2       3       4        Points off scale:  0
```

NO HAZARDS CATALOGED THIS SCAN

Input file: MDL.RIG.HOLE.04
File Creation Date : MON. AUG 08 1983   System time   23:05:12

```
                ** MODEL1 PARAMETERS  **
        HEIGHT FILTER COEFFICIENT =        0.25
        SLOPE FILTER COEFFICIENT  =        0.90
        LEVEL GROUND STEP THRESHOLD =      0.25 METERS
        SLOPE THRESHOLD =                 30.00 DEGREES
```

```
2.0 +                       ..
    |                     .       .
    |                 ..             .
    |
1.0 +              .                 .          X vs. Y for
    |            .                     .         hazards of
    |                                             scan #  1
0.0 +          .                         .       Number key:
    |                                            1 -- Insufficient data
    |            .                               2 -- Furthest return .LT. 1.5m
    |             .                     .        3 -- Slope hazard
-1.0 +              .                 .          4 -- Step  hazard
    |                 ..                           5 -- Crosspath hazard
    |                                             6 -- Bad data
    |                     .       .
-2.0 +                       ..
    -----------------------------------> X
     0       1       2       3       4        Points off scale:  0
```

NO HAZARDS CATALOGED THIS SCAN

Input file: MDL.BIG.HOLE.08
File Creation Date : MON. AUG 03 1983   System time   23:00:51

** MODEL PARAMETERS **

HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES
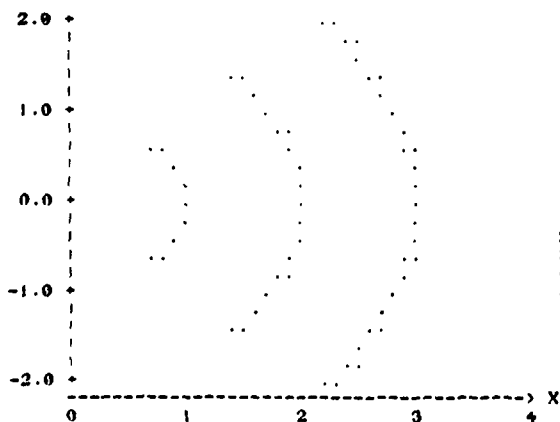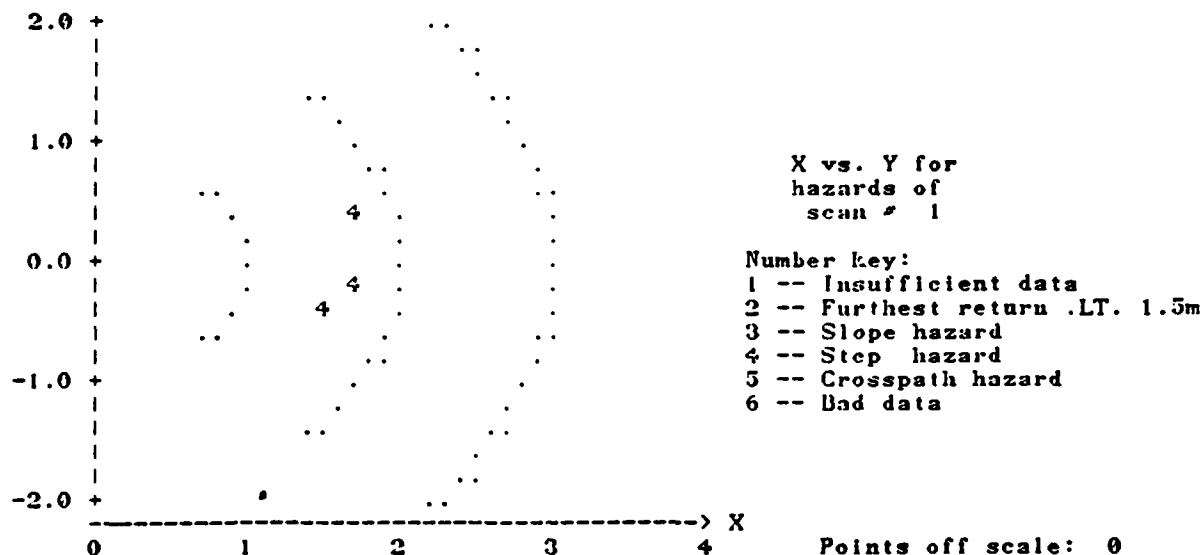
```
2.0 +
    |                              . .
    |                          .          . .
    |
1.0 +                      . .          .
    |                                             X  vs.  Y for
    |              . .            .      . .       hazards of
    |          .            4   .            .      scan #  1
    |              :                 .
0.0 +                          .                   Number key:
    |              :     4   .           .          1 -- Insufficient data
    |                  4   .             .          2 -- Furthest return .LT. 1.5m
    |              . .            .      . .         3 -- Slope hazard
    |                        . .                     4 -- Step  hazard
-1.0 +                    .           .              5 -- Crosspath hazard
    |                        . .                     6 -- Bad data
    |                  . .          . .
    |                            . .
-2.0 +              .          . .
    +--------------------------------------> X
    0        1        2        3        4          Points off scale:  0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	1.55	1.51	-0.34	-0.21	Step hazard
13	-9.84	N O	H A Z A R D S	C A T A L O G E D		
14	-7.02	N O	H A Z A R D S	C A T A L O G E D		
15	-4.22	1.71	1.71	-0.13	-0.25	Step hazard
16	-1.41	N O	H A Z A R D S	C A T A L O G E D		
17	1.40	N O	H A Z A R D S	C A T A L O G E D		
18	4.21	N O	H A Z A R D S	C A T A L O G E D		
19	7.02	N O	H A Z A R D S	C A T A L O G E D		
20	9.83	N O	H A Z A R D S	C A T A L O G E D		
21	12.64	1.71	1.67	0.37	-0.25	Step hazard
22	15.45	N O	H A Z A R D S	C A T A L O G E D		
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.BIG.HOLE.10
File Creation Date : MON, AUG 08 1983   System time   22:51:40

** MODEL1 PARAMETERS **
HEIGHT FILTER COEFFICIENT =   0.25
SLOPE FILTER COEFFICIENT =   0.90
LEVEL GROUND STEP THRESHOLD =   0.25 METERS
SLOPE THRESHOLD =   30.00 DEGREES

```
2.0  +
     |                          . .
     |                               . .
     |                                  .
     |                .                  . .
1.0  +             . .            .
     |                         . .           . .
     |          . .          .         X vs. Y for
     |        .        4   4    .            . .   hazards of
     |                     4   .               scan #  1
0.0  +        .            4   .
     |                     4   .            Number key:
     |        .                             1 -- Insufficient data
     |            4        .               2 -- Furthest return .LT. 1.5m
     |        . .                    . .   3 -- Slope hazard
     |                                      4 -- Step  hazard
     |             . .          . .        5 -- Crosspath hazard
-1.0 +                                      6 -- Bad data
     |              .              .
     |                         . .
     |          . .              .
     |                         .
-2.0 +                   . .
     ---------------------------------------> X
     0       1       2       3       4       Points off scale:  0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	N O	H A Z A R D S	C A T A L O G E D		
12	-12.64	1.55	1.51	-0.34	-0.22	Step hazard
13	-9.84	1.71	1.68	-0.29	-0.27	Step hazard
14	-7.02	1.71	1.70	-0.21	-0.27	Step hazard
15	-4.22	1.71	1.71	-0.13	-0.27	Step hazard
		1.71	1.71	-0.13	-0.27	Step hazard
16	-1.41	1.71	1.71	-0.04	-0.27	Step hazard
		1.71	1.71	-0.04	-0.27	Step hazard
17	1.40	1.71	1.71	0.04	-0.27	Step hazard
		1.71	1.71	0.04	-0.27	Step hazard
18	4.21	1.71	1.71	0.13	-0.27	Step hazard
		1.71	1.71	0.13	-0.27	Step hazard
19	7.02	1.71	1.70	0.21	-0.27	Step hazard
20	9.83	1.71	1.68	0.29	-0.27	Step hazard
21	12.64	1.71	1.67	0.37	-0.28	Step hazard
22	15.45	1.48	1.43	0.39	-0.26	Step hazard
		1.48	1.43	0.39	-0.26	Step hazard
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.55	N O	H A Z A R D S	C A T A L O G E D		

Input file: MDL.BIC.HOLE.12
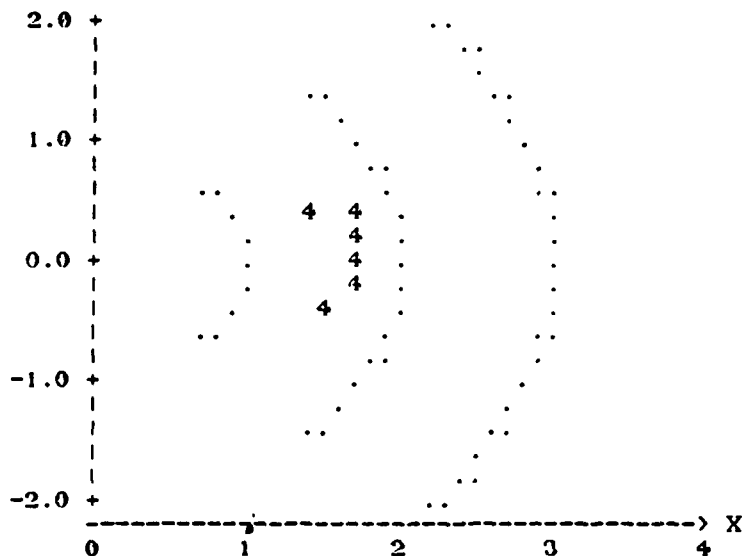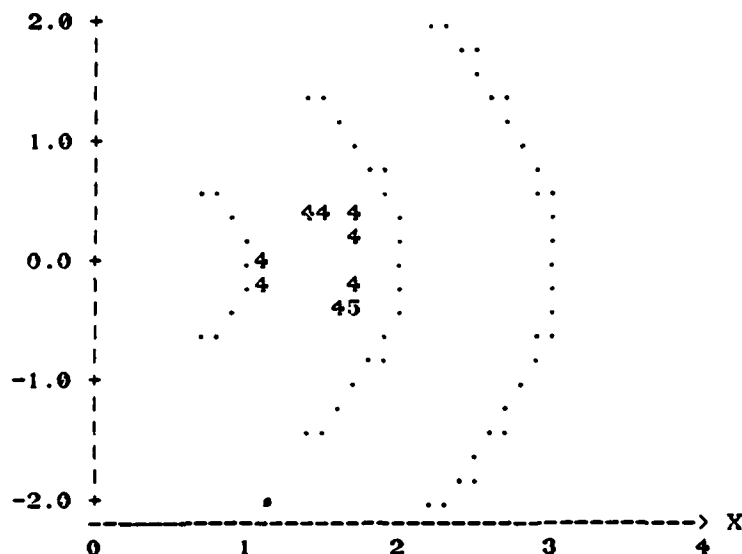File Creation Date : MON. AUG 08 1983   System time   22:45:28

```
                  **   MODEL1 PARAMETERS   **
         HEIGHT FILTER COEFFICIENT =          0.25
         SLOPE FILTER COEFFICIENT  =          0.90
         LEVEL GROUND STEP THRESHOLD =        0.25 METERS
         SLOPE THRESHOLD =                   30.00 DEGREES
```

```
2.0 +                              . .
    |                                  . .
    |
    |                       . .            . .
    |
1.0 +
    |                           . .         .
    |                    . .                     . .
    |              .      44 4    .
    |                     4
0.0 +           .4                 .                 .
    |             .4           4   .                 .
    |                      45      .
    |              . .              .             . .
    |                                .
-1.0 +                    .          .       .
    |
    |                          . .        . .
    |                             . .
    |                       . .          . .
-2.0 +               •         . .
    --------------------------------------------------> X
    0         1         2         3         4
```
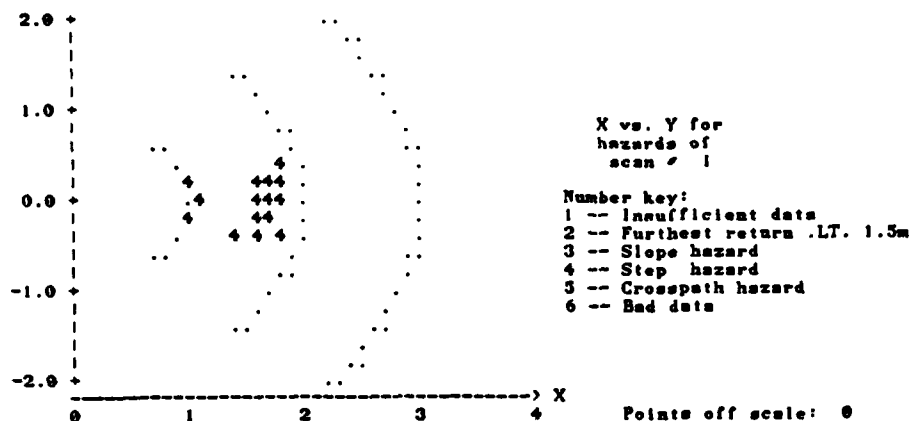
X vs. Y for
hazards of
scan # 1

Number key:
1 -- Insufficient data
2 -- Furthest return .LT. 1.5m
3 -- Slope hazard
4 -- Step hazard
5 -- Crosspath hazard
6 -- Bad data

Points off scale: 0

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N 0	H A Z A R D S	C A T A L O G E D		
2	-40.74	N 0	H A Z A R D S	C A T A L O G E D		
3	-37.93	N 0	H A Z A R D S	C A T A L O G E D		
4	-35.13	N 0	H A Z A R D S	C A T A L O G E D		
5	-32.31	N 0	H A Z A R D S	C A T A L O G E D		
6	-29.50	N 0	H A Z A R D S	C A T A L O G E D		
7	-26.69	N 0	H A Z A R D S	C A T A L O G E D		
8	-23.88	N 0	H A Z A R D S	C A T A L O G E D		
9	-21.08	N 0	H A Z A R D S	C A T A L O G E D		
10	-18.26	N 0	H A Z A R D S	C A T A L O G E D		
11	-15.45	1.75	1.69	-0.47	0.01	Crosspath hazard
12	-12.64	1.68	1.64	-0.37	-0.31	Step hazard
13	-9.84	N 0	H A Z A R D S	C A T A L O G E D		
14	-7.02	1.10	1.10	-0.13	0.00	Step hazard
		1.68	1.67	-0.21	-0.33	Step hazard
15	-4.22	1.10	1.10	-0.08	0.00	Step hazard
		1.68	1.67	-0.12	-0.33	Step hazard
16	-1.41	N 0	H A Z A R D S	C A T A L O G E D		
17	1.40	N 0	H A Z A R D S	C A T A L O G E D		
18	4.21	N 0	H A Z A R D S	C A T A L O G E D		
19	7.02	1.68	1.67	0.21	-0.29	Step hazard
20	9.83	N 0	H A Z A R D S	C A T A L O G E D		
21	12.64	1.59	1.55	0.35	-0.28	Step hazard
		1.71	1.67	0.37	-0.29	Step hazard
22	15.45	1.45	1.39	0.39	-0.28	Step hazard
		1.45	1.39	0.39	-0.28	Step hazard
		1.48	1.43	0.39	-0.28	Step hazard
23	18.26	N 0	H A Z A R D S	C A T A L O G E D		
24	21.07	N 0	H A Z A R D S	C A T A L O G E D		
25	23.88	N 0	H A Z A R D S	C A T A L O G E D		
26	26.69	N 0	H A Z A R D S	C A T A L O G E D		
27	29.50	N 0	H A Z A R D S	C A T A L O G E D		
28	32.31	N 0	H A Z A R D S	C A T A L O G E D		
29	35.12	N 0	H A Z A R D S	C A T A L O G E D		
30	37.93	N 0	H A Z A R D S	C A T A L O G E D		
31	40.74	N 0	H A Z A R D S	C A T A L O G E D		
32	43.55	N 0	H A Z A R D S	C A T A L O G E D		

Input file: MDL.BIC.HOLE.14
File Creation Date : MON. AUG 08 1983   System time   22:37:30

```
            ** MODELI PARAMETERS **
    HEIGHT FILTER COEFFICIENT =        0.25
    SLOPE FILTER COEFFICIENT  =        0.90
    LEVEL GROUND STEP THRESHOLD =      0.25 METERS
    SLOPE THRESHOLD =                 30.00 DEGREES
```



```
 2.0 +
     I                        ..
     I                       ..
     I                      ..
 1.0 +                 .           . .
     I            ..                           X vs. Y for
     I         .            . . .              hazards of
     I      ..              4                    scan #  1
 0.0 +     .4              +44 .
     I     .4              444 .               Number key:
     I      4              44                  1 -- Insufficient data
     I       .          4 4 4  .               2 -- Furthest return .LT. 1.5m
     I      ..                                 3 -- Slope hazard
-1.0 +         .                .              4 -- Step  hazard
     I             ..                          5 -- Crosspath hazard
     I                 .                       6 -- Bad data
     I                     ..
-2.0 +                        ..
     +----------------------------------> X
     0       1       2       3       4        Points off scale:  0
```

AZIMUTH	(deg)	RANGE	X	Y	Z	HAZARD TYPE
1	-43.56	N O	H A Z A R D S	C A T A L O G E D		
2	-40.74	N O	H A Z A R D S	C A T A L O G E D		
3	-37.93	N O	H A Z A R D S	C A T A L O G E D		
4	-35.13	N O	H A Z A R D S	C A T A L O G E D		
5	-32.31	N O	H A Z A R D S	C A T A L O G E D		
6	-29.50	N O	H A Z A R D S	C A T A L O G E D		
7	-26.69	N O	H A Z A R D S	C A T A L O G E D		
8	-23.88	N O	H A Z A R D S	C A T A L O G E D		
9	-21.08	N O	H A Z A R D S	C A T A L O G E D		
10	-18.26	N O	H A Z A R D S	C A T A L O G E D		
11	-15.45	1.41	1.36	-0.37	-0.28	Step hazard
12	-12.64	1.06	1.03	-0.23	0.01	Step hazard
		1.61	1.57	-0.35	-0.38	Step hazard
		1.61	1.57	-0.35	-0.38	Step hazard
		1.68	1.64	-0.37	-0.35	Step hazard
13	-9.84	1.06	1.04	-0.18	0.01	Step hazard
		1.86	1.83	-0.32	-0.37	Step hazard
14	-7.02	1.06	1.05	-0.13	0.01	Step hazard
		1.61	1.60	-0.20	-0.38	Step hazard
		1.68	1.67	-0.21	-0.35	Step hazard
15	-4.22	1.06	1.05	-0.08	0.01	Step hazard
		1.61	1.61	-0.12	-0.38	Step hazard
		1.61	1.61	-0.12	-0.38	Step hazard
		1.68	1.67	-0.12	-0.35	Step hazard
16	-1.41	1.06	1.06	-0.03	0.01	Step hazard
		1.68	1.68	-0.04	-0.35	Step hazard
		1.77	1.77	-0.04	-0.37	Step hazard
17	1.40	1.64	1.64	0.04	-0.37	Step hazard
18	4.21	1.64	1.64	0.12	-0.37	Step hazard
		1.84	1.83	0.13	-0.13	Step hazard
19	7.02	1.61	1.60	0.20	-0.38	Step hazard
		1.61	1.60	0.20	-0.38	Step hazard
		1.77	1.75	0.22	-0.31	Step hazard
20	9.83	1.06	1.04	0.18	0.01	Step hazard
		1.61	1.59	0.28	-0.38	Step hazard
		1.61	1.59	0.28	-0.38	Step hazard
		1.68	1.63	0.29	-0.35	Step hazard
21	12.64	1.06	1.03	0.23	0.01	Step hazard
		1.86	1.81	0.41	-0.37	Step hazard
22	15.45	1.06	1.02	0.28	0.01	Step hazard
23	18.26	N O	H A Z A R D S	C A T A L O G E D		
24	21.07	N O	H A Z A R D S	C A T A L O G E D		
25	23.88	N O	H A Z A R D S	C A T A L O G E D		
26	26.69	N O	H A Z A R D S	C A T A L O G E D		
27	29.50	N O	H A Z A R D S	C A T A L O G E D		
28	32.31	N O	H A Z A R D S	C A T A L O G E D		
29	35.12	N O	H A Z A R D S	C A T A L O G E D		
30	37.93	N O	H A Z A R D S	C A T A L O G E D		
31	40.74	N O	H A Z A R D S	C A T A L O G E D		
32	43.53	N O	H A Z A R D S	C A T A L O G E D		